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ABSTRACT

This IIEP seminar focused on administrative, management, supervisory, and decisionmaking techniques that are useful in the educational planning process. The techniques studied included: delphi, program evaluation and review technique (PERT), and program planning and budgeting systems (PPBS). Various experts presented papers on these techniques, and seminar participants later formed into working groups to study the application of these techniques to educational planning and decisionmaking problems. Papers written by members of these groups are included. (Author/JF)

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MANAGEMENT AND DECISION-MAKING IN EDUCATIONAL PLANNING

Contributions to a seminar
held at the International Institute
for Educational Planning
20-28 July 1970

Edited by Nathan Kravetz

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PREFACE

The annual Seminar organized by the International Institute for Educational Planning for the directors and professors of Unesco regional centres for planning and administration and for representatives of universities and other national training centres took as its theme in 1969 the Administrative Aspects of Educational Planning. This Seminar had several aims: to undertake an analysis of the work of planners, to study, with actual cases, the division and integration of responsibility among the various bodies involved; and to consider the desirable orientation and content of the training to be given to educational administrators in view of their planning duties.

The Seminar organized in 1970, which added to the above mentioned participants most of the Unesco educational planning experts working in Member States, took up and developed the themes of the previous year's meeting, in line with a policy agreed upon with the Department of Educational Planning and Finance of the Unesco Secretariat. Following the survey of administrative structures and functions made in 1969, the Seminar in 1970 was dedicated to the study of certain modern techniques of administration, management, supervision and decision-making which appeared particularly useful in the educational planning process.

From information and opinions communicated by the Unesco experts a basic working paper was prepared by Mr. L.H.S. Emerson, defining the major administrative problems for which satisfactory solutions still remain to be found and to which these techniques might be applied. This inventory in itself provides educational administrators with matter for thoughtful consideration.

The theoretical presentation of each of the techniques studied (Delphi, PERT, PPBS, RCB[1]) was immediately followed, as a general rule, by some practical examples of its application. The participants, formed into working groups, then studied the possibilities of such application to the major problems identified in Mr. Emerson's basic paper. The conclusions arrived at by the working groups were, on the whole, very favourable; they show beyond doubt the value for educational administrators and planners of the study and application of these techniques, even though they were originally elaborated for other purposes and none of them, as Mr. Nathan Kravetz emphasizes in his report of the Seminar, is the magic wand which will make all difficulties disappear.

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[1] The signification of these names and acronyms will be found in the papers that follow.

The papers describing PPBS and RCB (American and French systems respectively) were followed with the greatest interest - all the participants saw in this type of new approach to the preparation of budgetary choices the shape of things to come; but the practical application to educational budgets of the principles thus demonstrated presents the same familiar drawbacks, as cost-efficiency analysis in the realm of education, and much perseverance will be needed before they can be systematically generalized. Undoubtedly this is a subject which the IIEP, in its future research, will investigate in greater depth.

Nevertheless, the documentation of this Seminar and the practical work and discussions which accompanied the presentations, represent a definite step towards the adoption of these new techniques of decision-making, management and supervision in the field of educational planning. The Institute, in reproducing them, is fulfilling its appointed task of assisting all those throughout the world who are engaged in this work.

We offer our thanks, to all the participants in this Seminar and, in particular, to those who prepared and presented the papers contained in this volume. The opinions expressed in the documents are, of course, those of their authors and not necessarily those of Unesco or the Institute. Our thanks are due equally to our colleague Mr. Nathan Kravetz, upon whom rested the double responsibility of organizing the meeting and of preparing the final Report of the Seminar.

Raymond Poignant,
Director, IIEP

INTRODUCTION

Over the past year, and in the preceding several years, the International Institute for Educational Planning has been providing support training for Unesco field experts in educational planning. This Institute has also collaborated with directors and staff members of Unesco Regional Centres for educational planning in the continual maintenance and up-grading of their potential for ever-greater service.

Since we are all dedicated to the improvement of education in developing countries, it has been of necessity our task to study seriously the problems of planning, of implementation of plans, and of the elements calling for specialized attention in these two major aspects.

More importantly, it has been necessary for us to study actual conditions, to gain information from experienced experts, and to provide Unesco personnel with insight and concrete techniques for dealing with the problems which they encounter continually. More precisely, we have sought to examine, under conditions of relative tranquility and objective scholarship, the elements of reality which govern and influence the work of Unesco field personnel so as to find ways of enhancing their effectiveness and ameliorating the problems. Thus, over the past several years, the Institute has planned, organized and conducted a series of seminars designed to achieve the above purposes. Resources have been sought on a world-wide range and together with the personnel of the Institute and of Unesco, programmes have been organized to study and attack relevant problems. We have called upon rich human resources and have brought together international authorities on techniques, procedures, and methods of direct relationship to educational planning in developing countries. Throughout the seminars, emphasis has been given to finding out what works in specific situations and to providing impetus to Unesco field personnel to adapt, modify and use effective procedures.

Previous seminars have dealt with problems of cost analysis, manpower development, finance of education, and statistics. Also, they were conducted for the two groups (regional centre directors and staff, and field experts) at separate times and with different emphasis given to the topics, in accordance with the differing needs of the personnel.

For the 1970 Seminar it was decided to attempt a quite different procedure. In collaboration with the Department of Educational Planning and Finance, the Institute planned a seminar which would deal specifically with certain techniques of planning and decision-making for educational development: PERT, Delphi, and PPBS (planning-programming-budgeting system). These techniques, organized and actively operative in the United States of America, were presented by U.S. and French specialists to both groups of Unesco staff during a single series of seven days, 20-28 July. It was of particular interest that the techniques to be discussed were originally and are currently most effective in governmental and business operations and only recently have been in the process of adaptation to educational systems.

Although at first glance, one might question the appropriateness of such techniques in developing countries (due to lack of sufficient data and adequately prepared personnel), it is perhaps also a realistic hope that with such techniques data and personnel might be more readily assembled and trained, the utility of the techniques being then immediately recognizable. Further, as with other educational innovations (use of mass media, reformed curricula, improved training methods, and standardized modular school construction), developing countries might be enabled to take some 'giant steps' in progressing toward expanded, more effective educational operations. There seems to be, in such context, no need for developing countries to follow the developed ones in the laborious, step-by-step sequences of change which the latter have experienced.

Thus, with the decision taken to emphasize new techniques for educational planning and management, it was anticipated that, as with previous seminars, the participants would receive specific aids for their work. In sessions where they would practice the utilization of Delphi, PERT and PPBS concepts, they would note the applicability of these procedures and increase their potential for service. Special note was taken that there are various other procedures which utilize systems-analytical concepts including simulation, relevance trees, cross-impact matrices, operations research, model-making, etc. However, given the considerations of time and the assumed prior experiences of the participants, it was decided to organize the seminar within the specified limits. Further study, feedback, and evaluation would indicate the organization to be taken in future seminars, the additional materials to be needed, and the specific techniques to be explored intensively.

Of basic importance in the planning of the Seminar and in the organization of the sequence of seminar activities was the questionnaire which was sent to field personnel. It was considered of primary importance to seek information from Unesco's active workers in developing countries about their problems and their concepts about the 'bottlenecks' which they face in the planning and implementation of plans.

This questionnaire was prepared in the Department of Educational Planning and Finance and was distributed to field experts. The returns by the experts were in almost all instances full reports about their problems indicating where the 'bottlenecks' were, and stressing the major aspects of their work which were affected. These returns were studied, compiled, and organized in the format which is included later in this report (Problems in Educational Management, consultant L.H.S. Emerson).

The responses of the experts were distributed over a broad range of aspects. However, the most widely reported element was that of planning: "Lack of planning is in fact the main cause of many of the management problems experiences ... " (p. 9).

The management problems most frequently referred to were concerned with school building, school map, curriculum development, and teacher recruitment, training and employment.

It seemed evident that consideration of these problems by small working groups would be of benefit to seminar participants, particularly with the opportunity to utilize the proposed techniques for management and decision-making in educational planning. Therefore, individual participants were invited to state their preferences as to the four problem areas referred to above (as well as their language preference). Groups were formed which were to work on the problems during the fourth and fifth days of the Seminar utilizing the techniques which were presented earlier.

At the start of the Seminar it was stressed by the Director of the Institute, Mr. Poignant, by the Director of the Department, Mr. Platt, and by this rapporteur that the seminar activities were to be dedicated to the learning of new methodologies which might be applied in the solution of problems, rather than to the development of a formula which would be a universal panacea. It was recognized that there is no 'package' which can be applied in all cases, and that some situations do not lend themselves to ready treatment. There are, after all, in the experiences of Unesco field staff (and regional and headquarters staff as well), such unforeseen and unmanageable events as elections, revolutions, wars, the discovery of new resources, economic rises and falls, and natural disasters such as earthquakes or floods.

The Seminar was, therefore, dedicated to the examination of new techniques, studious review, objective discussion, and considerations of practicability. The activities of the seven days proceeded in this context and were marked with serious presentations by acknowledged authorities and with equally serious study and discussions, all aimed at bringing into effect innovations of considerable power for education in developing countries.

As the first speaker of the Seminar, following his introduction by Mr. Poignant, Mr. Frank Davidson established the broad, exploratory view of recent developments in techniques of decision-making which set the tone for the discussions and activities which followed.

In his introductory statement, Mr. Davidson developed the important concept of analysis. He helped us to examine the 'education explosion' and its consequences. We looked at the potential of educational futures and noted that with PERT as with PPBS and Delphi we do not necessarily make decisions. We get, rather, the kinds of information that give decision-makers future alternatives. Planning, therefore, depends upon analysis - often multi-disciplinary, calling for economists to join with educators, as well as with sociologists, political scientists, and others, to develop the best possible alternatives.

Mr. Davidson encouraged the members of the Seminar to think ahead, toward the potential uses of technology, including reaching out to panels of experts by means of regional or even broader D-nets, non-school, non-classroom instruction (but effective instruction just the same), centralized learning centres, data centres, and laboratories for educational studies, all perhaps supported by a 'World Bank for Educational Development'.

An important reminder was of the need to recognize that we are preparing educational plans, not for a continuation of today's conditions, but for a future which is clearly different and which can be anticipated in its broad outlines. For such circumstances, we are required to determine, not only objectives, but educational indicators. Evaluation of education, of goals, of processes, and of outputs, thus became a key-note in the first document and in those which followed.

Mr. Helmer provided an opportunity for the participants to experience one form of analysis: the kinds of assumptions and priorities that experts can provide to help with decision-making. In carrying out a simulated Delphi procedure, we assumed the role of experts and saw how projections of future possibilities can be provided to planners and decision-makers. In this procedure, emphasis was given to the proposition that anonymous thought and response may be more useful than direct, face-to-face discussion where the effects of hierarchy, of personality and personal dynamics, or of other restraints may produce less than objective opinions and suggestions.

In both the exercise and the discussion, attention was paid to the problem of finding experts in developing countries and of eliciting Delphian responses in time for them to be of use. Potential was foreseen where regional personnel (or Paris-based Unesco personnel) could serve as expert panels through electronic devices and thus remedy the lacks just described.

With the extensive PERT discussion, ways were presented for the organization of thinking and for the development of procedures for accomplishing tasks both effectively and economically. It was demonstrated that all tasks require time and cost money, that inputs of expertise were also necessary to provide sufficient data for a PERT network - and finally, the application of PERT procedures was shown to be feasible in developing countries given the availability of data and personnel.

In the exercises which accompanied the PERT portion of the programme, utilizing Madagascar and Ivory Coast data, numerous participants found themselves intrigued and encouraged by the facility with which they could begin to use the technique for situations similar to their own.

In the PERT exercises as in the Delphi, emphasis was placed upon analysis of situations and then upon the use of procedures for dealing with the problems at hand, logically and in reasonable order.

A specific caveat with regard to PERT is that while it may appear to be a matter of simple logic to establish a sequence of related activities, a major problem may develop. That is, the formation of a network in a given sequence may not have the appropriate input by experts in the field. The resultant network, though admirable in its 'logic', may not represent the best procedures now available. A PERT network which fails to take note of all possible information needed for constructing its sequenced logical parts may then become a means of 'cementing-in' out-moded procedures - which would not serve the over-all system well at all. Such a network would, in fact, be a negative factor rather than a positive one in the development of an educational system. Specific examples of such cases would be in the failure to take account of new procedures used for evaluating student progress, revised teacher training methods, and new curricula.

When the discussion of PPBS was presented, the stress was again upon analysis. This time it was with regard to educational goals which, in time, would become outputs to be evaluated. Both Dr. Mushkin and Mr. Pineau who discussed the French R.C.B. (rationalisation des choix budgetaires) showed how the aims of education require definition.

The ensuing processes then call for costing, justifying, and rationalizing, so that reasonable choices can be made and benefits realized. Once again, however, we were reminded of the challenge which needs to be met: that of determining how to measure what has been achieved, in terms of cost, of social return, of economic return, and of individual personal growth. Basically, we continue to have a need to know not only our objectives, but how well we are achieving them. This we call continuous evaluation.

Mr. Barber, in his discussion, focused upon a limited task, that of reading and arithmetic. Here we could appreciate that achievement of such goals can be measured. He reminded us that this limited task, although fully desirable, was not all of education - nor the only goal orientation we should have.

Nevertheless, he opened for us a very tempting package - that of pay-offs for learning: pay-offs to the teacher, pay-offs to the child, pay-offs to the happy parents who saw gains in vocabulary and, at the beginning at least, pay-offs to the entrepreneurs who go into the community and promise that they can bring about better test results. Certainly a pay-off of major considerations is the proposal that such gains may be had at significantly lower cost to the educational budget than has been paid traditionally.

Our final discussion of output-oriented instruction in reading and arithmetic brought forth some indecision about such procedures in developing countries. However, we must continue to ask: what motivation can we offer to maintain and increase school attendance, to reduce wastage, to obtain professional service by teachers and to achieve measurable gains in achievement, all at appropriate costs?

Following the discussions of the Delphi techniques and of PERT, the seminar members were divided into four working groups as was previously described. The groups (on school map, school building, teacher recruitment, training and employment, and curriculum development) were invited to discuss these problems in the light of the procedures which had been presented to them.

Each of the groups had its own working area and was reminded that individual consultants would be available to them and would join them in their deliberations. Once again, it was stressed that the focus of the working groups was not upon the immediate solution of the 'bottleneck' problems, but upon the uses which might be made of Delphi, PERT and other decision-making aids to planning.

The results of such group work are to be found in the working group reports. However, what these reports may not communicate well enough is the intensity of the participation by group members, the continuing discussions with reference to practicability which were noted, and the effective motivation shown by the participants to learn and apply the methodologies offered. While we gave no achievement tests to the enthusiastic 'students', there was ample evidence of their interest and achievement.

In reviewing the Seminar, we would wish to refer to a number of comments and suggestions which were offered by various participants during the sessions of the Seminar, both formal and informal.

Regardless of the methodologies suggested, Unesco field personnel should note that old concepts are often brought forth under new names, that change is perhaps the most universal aspect of work in developing countries, and that we are still faced most immediately with those two major lacks: correct and sufficient data and adequately trained personnel.

Attention was called to the doubtful effectiveness of even the most logical management procedures in the face of requirements for decisions coming from time pressures, from the conflicts which may arise among popular demand, political expediency, and economic resource feasibility. The sensitivity of experts and consultants to such influential factors must be developed.

It was proposed in some quarters that the work and the objectives of such seminars could indeed be improved if each expert had at his side throughout the period a responsible counterpart official of the ministry in which he is assigned. While the costs of such arrangements were not calculated, it was suggested that the true objectives of Unesco field assistance might more readily be achieved with such 'dual' seminar participation.

To sum up the Seminar and its experiences, we can indicate the following:

(a) the applications of Delphi in decision-making for educational planning in developing countries are problematic. The direction of practicability is toward the development of experts who are competent in each country to participate in forecasting procedures. The immediate alternative is to seek international panels of specialists who could perform such functions as regards problems in developing countries.

Ultimately, one might look to Delphi-nets of a multinational nature which could participate in priority determination via computerized communication channels,

(b) PERT procedures would appear to be feasible in developing countries at this time, given the opportunity for the development in depth of specialized personnel. Such time-saving and cost-rationalizing processes would justify, rather soon, the training and development costs. Training and operation activities might be combined in such projects as the development of school construction, curriculum development and similar projects. It is, of course, important to note that PERT processes themselves depend upon decisions which initially might result from relevant DELPHI operations. The inter-relationship of such methods was stressed throughout the Seminar;

(c) as regards PPBS (French R.C.B.), it would appear also that practicability requires intensive training of personnel and the clarification and elaboration of the sequence of processes which are involved. At the very least, it might be expected that the initial phases (determination of projects and clarification of objectives for each project) would be salutary and could be undertaken. Further development would need to wait upon the availability of personnel and the improvement of data-collection processes,

(d) output-oriented education management seems to call into question the time-honoured concept of intrinsic motivation on the part of students and the professional and ethical dedication of teachers. For developing countries, with their large numbers of under-qualified teachers, their already highly-motivated students, and their already large education budgets, pay-offs for learning seem to be non-feasible and unattractive. Further experience with output-oriented management is needed so as to provide more convincing data than have yet been received.

We would hope that following the experiences of this Seminar and the ensuing field activities of its participants, highly specific feedback and practical data might become available for further study.

Nathan Kravetz

INTEGRATIVE ANALYSIS AND THE FUTURE OF EDUCATIONAL PLANNING

by Frank Davidson

This paper will canvass current problems of educational planning, discuss methodology, and endeavour to identify key areas for further research and action. During the next decade, expected changes in technology and its costs could be of such magnitude that reassessment of educational structures will be commonplace. For this reason, even a pedestrian overview of school systems and their contextual setting may well impact on far-reaching questions of institutional design.

At the outset I propose to summarize essential characteristics of the 'education explosion'. this will provide a basis for consideration of some of the methods used by educational planners in allocating scarce resources. Attention will then be focused on the emergence of procedures and institutions specializing in the application of 'social engineering' methods to the analysis of alternative futures. Finally, some suggestions will be made for strengthening international resources available to educational planners.

The last two decades have certainly witnessed an unprecedented world-wide expansion of educational systems. In 1965, a respected commentator reported that in Latin America expansion of primary education:

> "equals 5.7 per cent per annum, which is twice the rate of expansion of the primary school age group. It reflects therefore not only the requirements of an expanding population, but above all an increasing demand for education."[1]

With respect to Africa, the Pearson Commission concluded that:

> "between 1955 and 1965 primary school enrolment more than doubled, as universal education became accepted as a basic right. Enrolment in secondary schools, universities, and post-secondary institutions increased by 2.8 times. By 1965, 20.4 million children were enrolled in primary schools, 2.7 million

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[1] Sylvain Lourié, in Raymond F. Lyons (ed.), Problems and Strategies of Educational Planning: Lessons from Latin America, Paris, Unesco: IIEP, 1965.

> students were attending secondary schools - including vocational and teacher-training institutions - while 215,000 students from North Africa and 70,000 from Africa south of the Sahara attended institutions of higher education either in Africa or abroad."

Despite the foregoing:

> "The over-riding shortage in Africa is still trained manpower ... in most countries more than 80 per cent of the professional people are non-African."[1]

The Indian Education Commission has projected a six-fold increase in educational expenditures from 1965 to 1985.

But the world picture, present and prospective, has been clouded by such evident problems as:

(a) the high rate of drop-outs,
(b) the shortage of teachers (and especially of qualified teachers),
(c) the trend to increasing unit costs,
(d) the shortage of laboratories, libraries and other facilities for practical work,
(e) the failure to graduate cadres capable of participating effectively in economic development.

If it is true that, in many educational systems, more than two-thirds of the budget is used to pay for studies that are never completed, we are clearly dealing with fundamental questions of value and attitude: budgetary and planning deficiencies will not be overcome by mere improvements in methods of analysis, important though these may be.

The shortage of teachers has been traced to the fact that:

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[1] Partners in Development, Report of the Commission on International Development, New York, Praeger, 1969, pp. 268-269.

> "education is a mass production, labour-intensive industry, still tied to a handicraft technology."[1]

and that education has difficulty in offering competitive salaries to attract some of its own best graduates.

With national governments devoting ever larger percentages of their revenues to education, major efforts must clearly be made to improve the benefit-to-cost ratio of educational services: first, because competing constituencies will eventually prevent further increases in the proportion of GNP devoted to education and, second, because the very size and visibility of the 'education establishment' will bring forth demands for professional management as a necessary ingredient of the legitimacy of prevailing arrangements.

What are some of the methods now available for the over-all economic planning of educational budgets and programmes? Can they be supplemented?

One widely respected procedure has been 'PPBS': the planning, programming and budgeting system. This is a programme-oriented concept designed to overcome the 'Parkinsonian' tendency of each government bureau to inflate its own budgetary requirements, at the expense of the claims of rival bureaux. By emphasizing explicit objectives and performance criteria for a programme seen as a whole, the government administrator is assisted in evaluating, quantitatively, resource and monetary inputs in terms of programme effectiveness. Moreover, by insisting that the programme make sense in the long run, a mechanism is provided for harmonizing strategic (long-range) planning and tactical (annual) budgeting. The resulting framework can reduce inter-agency friction while encouraging the assignment of joint responsibilities for programme implementation. As a management system, therefore, PPBS creates attractive opportunities for implementing the findings of cost-effectiveness analyses.

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[1] Philip H. Coombs, in C.E. Beeby (ed.), Qualitative Aspects of Educational Planning, Paris, Unesco. IIEP, 1969.

Like PPBS, PERT (the initials stand for Programme Evaluation and Review Technique) is a child of 'operations research'. Churchman has defined OR as:

> "the application of scientific methods, techniques, and tools to problems involving the operations of systems so as to provide those in control of the operations with optimum solutions to the problems."[1]

The particular value of PERT in the planning of educational systems is its emphasis on a graphic network for scheduling and budgeting so that unfavourable as well as favourable developments can be identified and communicated before they occur. PERT charts pinpoint critical factors for management appraisal. Schedules can be readjusted in accordance with 'critical path' assessments. Industrial firms have achieved savings of up to 20 per cent by adopting PERT, the system is well worth considering as a planning and control mechanism to be used in educational planning - particularly to monitor plant and equipment expansion and the quantifiable elements of personnel flows.

Recent years have been marked by an accentuated awareness of the pace of technological change and the extensive effects of technology on our values, habits and institutions. Planners have become aware of the futility of assuming that the future can be extrapolated from the past on a linear basis; indeed, it has become fashionable to foresee and delineate discreet 'alternative futures' so that governments, industries, and school systems can have a better picture of what the world is likely to be at stated intervals in the future.

In the words of Warren L. Ziegler:

> "... the activity we call 'planning' must begin to take a longer-term view - perhaps as much as 15, 20, 30 or more years.

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[1] G.W. Churchman, R.L. Ackoff, and E.L. Arnoff, Introduction to Operations Research, New York, John Wiley and Sons, 1957, pp. 8-9.

A second assumption is that planning must become more comprehensive. It must take into account a greater number of factors, both educational and non-educational. A longer-term view and a more comprehensive view, taken together, constitute what we call long-term futures-planning for education."[1]

In opting for the systems-analytical 'long-term view', educational planners reflect the growing interest of government and industry in mechanisms, however tentative and experimental, for the discernment of future patterns of social development. Basic theoretical work in Europe and America made it possible to envisage the institutionalization of systematic and comprehensive studies of the long-range future. Dennis Gabor (in Inventing the Future) stated with great persuasiveness the case for 'social engineering' to avert potential social disaster. Baron de Jouvenel, leader of the Futuribles group, in The Art of Conjecture[2], advocated permanent research centres to identify possible alternative futures and to encourage the democratic process of choosing among them. In America, the success of multi-disciplinary analysis in the defence and aerospace fields led to long-range planning and programming efforts in other federal departments.

In private industry and the foundations as well, specially appointed personnel are beginning to look critically at possible long-term futures in order to derive appropriate guidance for investments and operations. Professional societies of long-range planners have come into being, and major corporations have established departments of long-range planning.

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[1] Notes on the Future of Education, Vol. 1, Issue 2, January-February 1970, Educational Policy Research Center, Syracuse, New York.

[2] Baron Bertrand de Jouvenel, The Art of Conjecture, New York, N.Y., Basic Books, 1967.

Concomitantly, professional planners within international organizations have come to recognize that the ramifying problems of the developing countries, of population control and of the reduction of poverty will require far-sighted and comprehensive approaches. But there is a general awareness that organizational resources for the analysis of the future remain deplorably inadequate.

Recently, a number of institutions have been established in order to focus senior professional talent on problems on the long-range future.[1] In Venezuela, for instance, the private sector has taken the initiative in founding a Centro de Estudios del Futuro de Venezuela, which publishes an excellent quarterly magazine and conducts systematic studies of the country's long-range future.

The Institute for the Future in Middletown, Connecticut has conducted research, both nationally and internationally, with a view to testing and improving methodology and adding to the world's fund of data about basic future trends and discontinuities.

More than a score of centres for monitoring or conducting studies of the future have now been established in Europe, Asia and the Western Hemisphere. The output of these centres may be regarded as an increasingly useful resource for planners and decision-makers.

What are some of the methods employed in futures research? Herman Kahn and his colleagues at the Hudson Institute have developed the writing of scenarios:

> "to describe in some detail a hypothetical sequence of events that could lead plausibly to the situation envisaged. ... The scenario is particularly suited to dealing with events taken together - integrating several aspects of a situation more or less simultaneously. By the use of a relatively extensive scenario, the analyst may be able to get a feeling for events and the branching points dependent upon critical choices.

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[1] Chemical and Engineering News, Vol. 47, August 11, 1969, pp. 62-75.

These branches can then be explored more or less systematically or the scenario itself can be used as a context for discussion or as a 'named' possibility that can be referred to for various purposes."[1]

While the writing of scenarios can be most useful "as a primitive, one-man mode of simulation"[2], "reliance on the use of expert judgment though often unsystematic is more than an expedient, it is an absolute necessity".[3]

Helmer and Dahlke developed over a period of years distinct procedures for the selection of panels of experts who agree to answer specific questions as to the likelihood and impact of listed events.

In another paper at this conference, there will be a discussion of the Delphi method, as a means of gathering information about particular aspects of the future. I submit that the Delphi method may have value to educational planners far beyond the mere technicalities of the system. Essentially the method involves - sending questionnaires - to a panel of experts, and refining both the questions and the answers as a result of successive feedbacks of information and opinion from the respondents. Of course the respondents are not identified to each other, this permits extreme views as to the likelihood (or impact) of a future event to be circulated anonymously to the entire group, so that opinions can be re-assessed calmly, in the light of new evidence or reasoning. Experience has indicated that after four rounds of a well-conducted Delphi survey the reliability of a group forecast is improved by about 20 per cent. The product of a Delphi exercise is a list of future events or developments and a combined judgment as to the probability of their occurrence - or non-occurrence - within a stated period of time. Of course there is always the possibility that if one of the predicted events occurs it may make all or some of the rest of the list impossible - or less likely, (or more likely). For this reason, scientists at the Institute have developed the cross-impact matrix as a method of assessing the likely interaction of future events. T.J. Gordon, in his pioneering analysis[1], reasoned that the events interact through mode, strength and time. That is, if event No.1 should occur, it may make event No.2 (or a whole set of events) more or less likely. Further, one can assign percentages to the increased or decreased likelihood of the second event (or set of events). And finally, the effects of event No.1 may be felt immediately, or in the more remote future.

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[1] The Year 2000, MacMillan, 1967, p. 262.

[2] Olaf Helmer, Social Technology, Basic Books, 1966, p. 10.

[3] Olaf Helmer, Social Technology, Basic Books, 1966, p. 11.

By employing the best judgment of panels of experts on likely cross-correlations among future events, the cross-impact matrix has made it possible to take into account great numbers of variables in the construction of alternative futures. I think it is accurate to say that the cross-impact matrix represents the most advanced state-of-the-art in long-range forecasting.

Modern social and engineering science makes frequent use of 'models' and 'simulations'. Models are:

> "conceptual or mathematical formulations not only of concrete things (such as airplanes, bus stations, or missile systems), but also of abstract relations between things ... Simulation is an act or process, conducted either by persons and/or devices, by which a model or a hierarchy of models is made to imitate reality."[2]

In addition, 'games' and 'game theory' are employed in forecasting.

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[1] Futures, Volume 1, No. 2, December 1968, p. 100.

[2] Models and Simulations - Some Definitions, Dennis L. Little, IFF Working Paper, WP-6.

In the military field, an early methodological step was the invention of the 'Kriegspiel' (war game) which enabled general staffs to postulate an opponent's reactions to a military plan. In 1939, President Emeritus Lowell of Harvard, in a famous speech[1], called for a 'peace game', so that diplomacy would have at least a minimum armory of methodological approaches.

Ultimately, the principal findings of futures research will be housed in data banks to which instant access will be provided on an international basis. Meanwhile, it has been suggested that an 'invisible college' of experts be marshalled, not within the narrow confines of university departments, but grouped around certain central educational problem areas on an inter-disciplinary basis. Each panel would be linked electronically with the experimenter and with data banks so that Delphi and cross-impact studies can be accomplished on short notice, without the delays incidental to correspondence through the post office. Once in operation, such a 'D-net' could be of inestimable benefit to educators and educational planners. Multi-disciplinary experience and judgment could be directed to the solution of specific problems. By cross-examining each other anonymously, and hence without embarrassment, conclusions can be arrived at dispassionately and in the light of tested evidence.

One of the problems in obtaining high quality plans and reports from monolithic bureaucratic structures is the absence of competitive endeavours. To remedy this situation the civil engineering profession has perfected a system called 'design work study'. this involves the appointment of two competing teams within the same organization. Each team is given identical assignments and data, and is encouraged to come up with the preferred engineering solution. Although at first glance it might appear that the scheme is wasteful of the time of highly qualified and therefore expensive talent, in fact it was turned out that the presence of competition leads to enormous savings and often to ingenious and useful innovations. Where large sums of money - and, more important, the futures of millions of people -- are at stake, a bit of competition in planning is not such a bad idea.

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[1] Published in Before America Decides: Foresight in Foreign Affairs, Harvard and Oxford, 1938.

Perhaps the 'world' of education could benefit from a series of centres modelled on INSEAD[1] so that educational administrators can obtain the specialized training in management now widely regarded as a necessary infra-structure improvement. Such centres could also develop case materials on the planning and management of education, this would be a useful contribution to comparative management studies, and would have the further merit of contributing to a data base of direct relevance to the problems of developing countries.

It is a truism that even the most advanced methods of planning and programming cannot be more effective than the reliability of the data on which they are based. It is, therefore, fundamental to forecast probable future environments for education, so that all who are concerned in the educational planning process can have the best possible information on the future constraints as well as the future options which constitute the context of 'implementation'. Is social science equal to this formidable task? Despite obvious difficulties of definition and procedure, the effort must be made. Experience at the Educational Policy Research Center in Syracuse suggests that significant progress can be made in this domain, the very process of making the effort has the merit of compelling practitioners to make their assumptions more explicit.

As the 'information revolution' spawned by the proliferation of computers and communications becomes ever-more pervasive, teachers and students throughout the world will become more boudtful about the adequacey of 'the school' as a discreet institution and will be looking for rapid and reliable access to the world's information. At the university level, libraries will be increasingly co-ordinated so that research materials in one library can be made readily available (by facsimile transmission) to other libraries. Moreover, certain types of instruction will be diffused through radio and television, and ultimately over the telephone, in order to enrich the intellectual and cultural resources of individual schools, offices and homes. It would be wrong to regard these developments as in the nature of 'expensive toys' suitable only for rich countries. While rigorous cost-benefit analysis is needed on a case by case basis, the fact of the matter is that message unit costs as well as the cost of computer time and of terminals will be dramatically reduced in the coming decade. Present costs and systems should not blind us to the future potentials of a computer and communications revolution which is on the way. For those who do not wish to be 'oversold' on teaching machines and other forms of electronic gadgetry, a review of publications by the Harvard Program on Technology and Society will be comforting, but integrative analysis suggests that educational planners would make a grave mistake if they failed to appreciate the scope of coming technological developments. True, few systems exist today that can be recommended for instant application; but there is an urgent need for central laboratories capable of developing and evaluating programmes utilizing the new technology. Perhaps regional centres are needed, as deliberate focal points for the co-operation of industry and education in the development and use of advanced technology systems for education. I suspect that the real problems will be found in the domains of pedagogy and organization rather than in the fields of technology and finance.

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[1] European Institute of Business Administration, Fontainebleau.

Throughout the world, more television and radio channels will be available than can be intelligently used. With broad-band cable television in the home (1980?), the shortage of valid programmes will assume crisis proportions. A proliferation of institutions will be needed to close 'the programming gap'.

As an intermediate step one can foresee the emergence of 'learning centres' to provide students with 'interstitial' information of all sorts. For instance, children particularly gifted for advanced mathematics or unfamiliar languages, may wish to pursue these subjects independently, by taking courses on prepared tapes. Even in favoured 'wealthy' countries, the principle of shared facilities can mark a significant advance over current procedures, particularly in urban areas where individual schools cannot afford specialized equipment or personnel!

It may be admitted that new ventures, in education as in business, have a high mortality rate; however, institutional innovation, wisely guided, is a necessity of the future, and more flexible arrangements are needed so that school systems can collaborate on an active day-to-day basis with industrial and research organizations able to contribute in specific ways to educational methods and resources. Just as the Unesco with the financial assistance of the Ford Foundation, the IBRD and the Government of France established the IIEP, can we not foresee and encourage a host of other international ventures that could provide both developing and developed countries with pilot schools - veritable 'educational experiment stations' - which could serve as centres of both education and development?

One suspects that an inventory is needed of such innovative educational forms, so that planners, administrators and teachers may see at a glance the wide range of experience in this field and also to facilitate identification of developments that may be relevant to particular local situations.

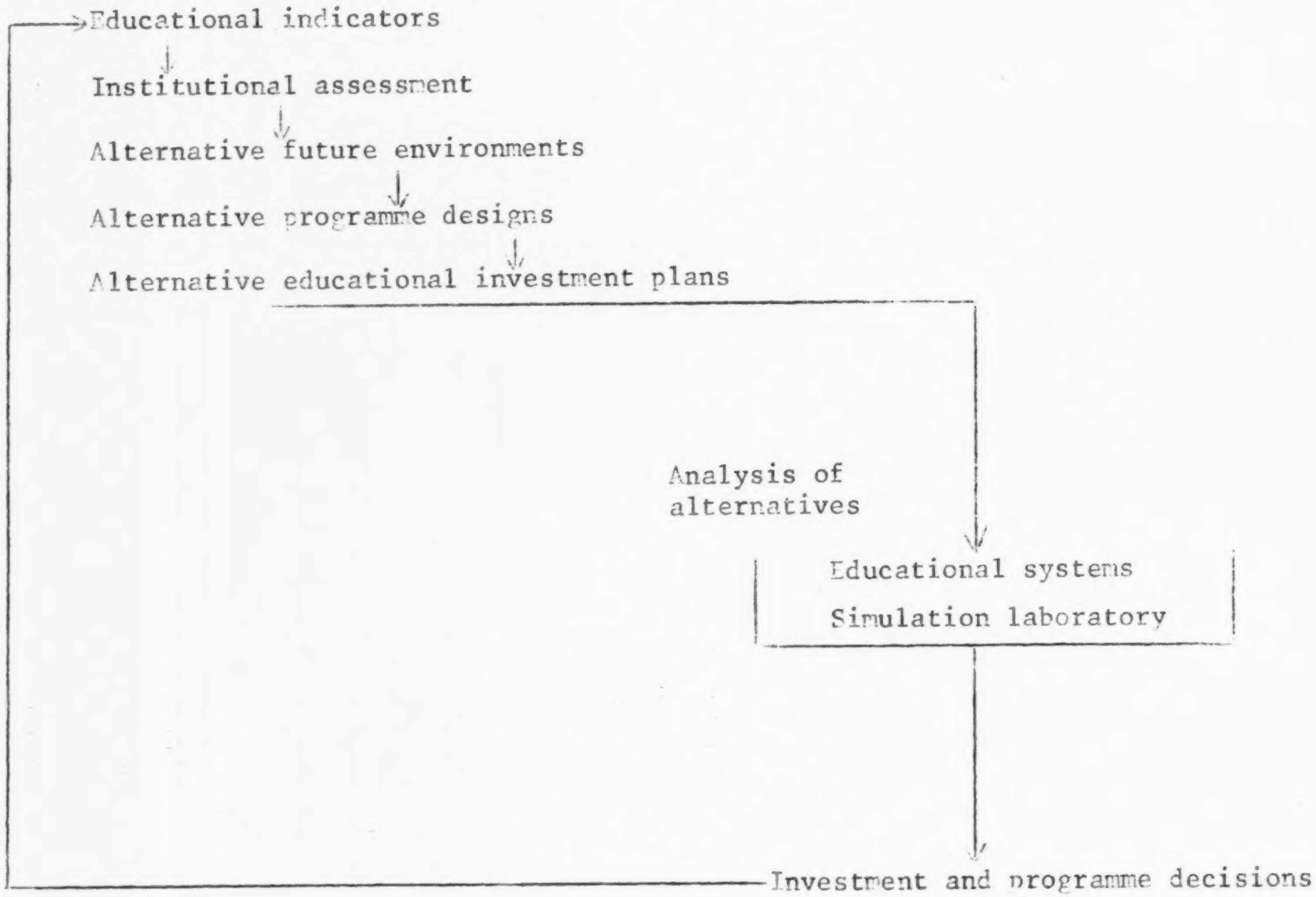
There has been a vast and growing literature on the interaction of education and development. Planners well know that they cannot expect to test the validity of alternative plans, except within strict limits, by experimenting with groups of people. The closest approximation to this is to simulate effects of alternative plans. It seems logical, therefore, to recommend and encourage the establishment of a simulation laboratory specializing in the relationship of development to education. Such a laboratory could be available on a contract basis to both international and national planning organizations, and could help test models and methods of practical benefit. This is far too costly an enterprise for a single country. The simulation laboratory could double as a training ground for civil servants and administrators concerned with educational and development planning and might well be the subject of detailed investigation by an IIEP study group or commission.

Research is needed aiso into the technology of finance for education. Here, too, an inter-disciplinary approach seems most promising: a commission of educators, civil servants and bankers might well discover a need for innovative financial institutions in the field of education. For instance, a bank for educational development, established on an experimental basis with the assistance of foundations and other agencies from private and public sectors alike, might assess and underwrite opportunities for the achievement of economies through the use of advanced technology. Officials of the World Bank, drawing on their experience of co-operation with Unesco, would be particularly valuable as counsellors in any such undertaking.

Pilot programmes should be encouraged even if they fall outside the traditional realm of the formalized school. Not all technological innovations need find their first market in a developed country: developing countries, through the greater flexibility of their structures, could be among the first to install broad-band home television as an educational device. Moreover, there is no reason why a variety of organizations in advanced countries cannot sponsor particular centres for schools in developing countries. Centres of excellence already exist in India, Mexico, the Philippines, and many other developing countries. Should there not be a concerted effort to establish or strengthen institutes of advanced technology in Africa, Latin America and Asia?

A final word as to the procedure of this conference. Could there not be a permanent consultation, in the form of a D-net on

Flow chart for institutional assessment and innovation


Educational indicators
Institutional assessment
Alternative future environments
Alternative programme designs
Alternative educational investment plans
Analysis of alternatives
Educational systems
Simulation laboratory
Investment and programme decisions

educational innovation, so that data and experience in the various member countries can be made available internationally without inordinate delay and expense. In this manner the dialogue represented at such conferences as this can be continued on a disciplined basis and a dynamic interaction of experts and operators thereby fostered.

A model for an institute fostering educational innovation might be EDUCOM, a consortium of North American institutions of higher education which joined together to share physical and intellectual resources. This non-profit organization has been supported by foundations and industries and now has more than 100 member institutions. Known officially as the 'Interuniversity Communications Council, Inc.', EDUCOM was organized in 1964, in the State of Michigan, as a 'non-profit' corporation. Eight universities were the charter members, and the ultimate corporate authority remains a council made up of Institutional Representatives.

A number of private business organizations, some of them sponsored by multinational corporations, now provide and sell various technical educational services to school systems. The 'stakes of the game' are so high that it is becoming vital to marshal independent evaluations and testing resources, so that school administrations can have unbiased and expert counsel on the advantages and disadvantages of competing systems. The Educational Systems Simulation Laboratory proposed above would be well advised to establish dynamic international cross-linkages with leading organizations already involved in independent appraisal of educational methods and systems.

Just as it has taken many years of pioneering effort to establish the scientific basis for 'social indicators', we may now foresee the necessity for a sustained intellectual campaign to develop explicit 'educational indicators'. In the words of the 1969 Report of the Special Commission on the Social Sciences of the National Science Board:

> "... social science theory and research may offer significant insights into educational problems that have not yet been

explored in a systematic manner ... Considerable knowledge exists, based on research not done in educational settings, that has potential applicability to educational institutions and their operation ... alternative models of the educational process based on scientific conceptions of learning and socialization processes should be tested."[1]

Discussion and research, on an interdisciplinary basis, are urgently needed in order to launch a systems analytical search for explicit educational indicators. The development and testing of such indicators could be a primary task for the proposed laboratory. For those who wish to pursue the potential of simulation methods in the study of public policy, it may be worthwhile to review A Simulation Game for the Study of State Policies, a report of research conducted by the Institute for the Future and published (September 1969) under a grant from the Connecticut Research Commission. Artifacts of the game include 16 societal indicators. It was recognized that the glib phrase, 'the quality of life' is meaningless unless given precise operational definition. The 'societal indicators' constitute a specific form for representing 'the quality of life'.

The stated purpose of the simulation was:

"to test and refine methods that can ultimately be used to:

- identify possible futures for the State of Connecticut in the light of external (world and national) societal and technological developments;
- test the sensitivity of these futures to changes in the State policy reflected in alternative action programmes,
- identify the behaviour patterns of involved groups in assessing and reacting to societal conditions,
- develop an educational tool that can be of value in promoting a better understanding of social problems and their relation to vested interests and external influences.

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[1] National Science Foundation, Washington, D.C., pp. 24-25.

- determine the kind of information that is most useful to planners."[1]

The rapid increase in the literature of forecasting has led the Institute for the Future to propose the establishment of 'an international clearinghouse of futures research'. Such an archive, with ancillary data banks and distribution centres, could be profoundly helpful to educational planners.

Surely a major obstacle to effective 'societal engineering' has been an over-rigid compartmentalization of the 'think tank', in contradistinction to 'action organizations'. Newer and more flexible groupings are needed so that scientists and 'operators' can collaborate effectively in the development of innovative social institutions.

Planners, particularly in the field of education, can play a most useful catalytic role by sponsoring the formation of study groups which are at once interdisciplinary, intersectoral and international. Properly conceived, such 'study groups' represent a step beyond the 'think tank' and could be characterized as 'action tanks'. By combining both intellectual and financial resources in informal groups, research and development efforts can be improved in effectiveness. Of course much depends on the correct selection of study group goals and membership.

One possible field for such an approach is the development of communications satellite facilities for educational purposes. Some of the desiderata and proposals have been described by Dean Jamison in an AIAA paper Optimal Utilization of Communication Satellites for Educational Purposes.[2]

A less technical discussion of the same possibilities was ably presented to the Unesco Space Communications Conference, held in Paris, 2-9 December 1969, in a speech, Beyond Babel: The Century of the Communications Satellite, by Arthur C. Clarke.

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[1] Institute for the Future Report R-9, September 1969.

[2] AIAA PAPER, No. 68-421, April 1968.

For the 70's, one of the great tasks of educational planning will be to evaluate and come to terms with the great body of knowledge and experience described under such rubrics as 'operations research', 'systems analysis', and 'management science'. While making full use of such new approaches, educators must bear in mind that a model is no better than the data on which it is based and it is to those who live with the facts to whom even 'experts' must eventually turn. Moreover, it will be well to insist on the explicit definition of assumptions, goals and beliefs.

Perhaps semantic problems are at the root of much confusion in today's seething educational world. Must we not re-define and re-examine 'work', 'study', and 'play'? But perhaps I have raised enough questions.

THE USE OF EXPERTISE IN EDUCATIONAL PLANNING

by Olaf Helmer

Educational planning, like all planning, consists in setting policy and determining a programme of actions to implement the policy. Both parts of the planning process involve the use of experts. Choice between alternative policies requires the determination of preferences. Here reliance on expert advice is vital: the expert, acting either as a representative of the public to be served or as an interpreter of the desires of the ruling elite, has the task of selecting the alternative which ought to be preferred and of stating the reasons why it should. Choice between alternative courses of implementing actions requires expert forecasts of the likely consequences of each alternative programme. Thus the expert enters the decision process both at the moral and the factual levels.

Since reliance on the intuitive insights of experts is an inevitable feature of the planning process, it is well to give some thought to how expertise can be used most effectively. Also, in highly complex decision-making situations (of which educational planning decisions are a clear example), it will usually be advisable to defer to the judgment of several experts, in order to be sure that the many facets of the problem will receive proper attention. This adds the problem of how best to combine the opinions of a group of experts.

In dealing with experts, aside from selecting them wisely in the first place, it is of the utmost importance to create the proper conditions under which they can perform most ably and to process and retrieve effectively the often vague information which together they possess.

The requirement that an expert, or a group of experts, should be placed in the right conditions in order to perform well means that communication of valid information should be facilitated as much as possible without at the same time increasing the 'noise' level of false information. Here, the expert is greatly aided in his performance if he has ready access to relevant information that may exist elsewhere, in this regard, rapid progress in automated libraries promises much help with respect to recorded data. To provide access to intuitive knowledge that may not yet have been recorded, an expert's performance is enhanced most significantly by placing him in a situation where he can interact with other experts in the same field or in related fields covering other aspects of the same problem area.

Two particularly effective ways of encouraging productive interaction among experts are the Delphi method and simulated-planning exercises. Both are definitely applicable to the educational planning process.

Delphi can be used, for instance, to elicit proposals for educational innovations, to assess such proposals as to their effectiveness, desirability, financial and social costs, and incidental societal side-effects. Having thus obtained a set of appraised alternative actions for inclusion in a programme of educational reform, a simulated-planning conference among a group of educational experts can be an excellent device for composing a programme of actions that at the same time meets budgetary constraints and serves to implement given policy objectives.

What I would like to do now is to give just a very brief introduction and very soon thereafter ask you to help go through what is sometimes referred to as a simulated planning session. This will demonstrate, I hope, one of the ways in which the Delphi method might be applied to a planning process of the kind in which you are all interested. The Delphi method was invented, or made up, many years ago when we thought for the first time of devising some new method of dealing with the problem of using expert opinions as effectively as possible. The problem then, as has been the case in so many applications since, was one of making some forecasts about the future, and so we thought of the ancient oracle of Delphi and just dubbed the process the Delphi method. I hope it has not too much to do with that because the old Delphic oracle, as many of you probably know, was, if I may use American jargon, phoney. The story that I have been told at any rate was that the people who consulted the Delphic oracle had to stay somewhere underneath the base of the mountain in something like what we would now call a motel. They were held there for several weeks while messengers were sent back to the place they came from to collect information. It then appeared very miraculous when the traveller consulted the priestess, that she seemed to know so much about his background. I hope that the Delphi method as we use it now is not quite as phoney.

The Delphi method essentially is a technique for a systematic use of expertise. That is to say a systematic combining of the opinions of experts when, you might say, all else fails, but particularly when you are concerned with problems of the future and you do not have an adequate scientific theory on the basis of which to make predictions. Then, just about the only thing you can rely on are the informed opinions of people who know something about the subject. It then becomes a question of how to use such judgments most systematically and effectively. The traditional method has been to assemble a group of experts around a table and have them discuss the subject matter until they arrive at an opinion, a group opinion.

The question of whether Delphi has advantages over the committee system depends of course on the circumstances. It depends on how much information might be available among the experts you might want to consult. You have to think of the Delphi method as simply one way to process information. Now, as you all know, we are living in an age where we are going through a revolution in the whole field of information processing. If you are concerned with planning for the future, where of necessity you have to rely to some extent on intuitive judgment of the specialists in the various fields, there is the problem of how to process the information that is somehow contained in the heads of these specialists. What is the most effective way of combining the information that they have? Sometimes it has not even been articulated, they are only vaguely conscious themselves of having a good deal of information and it is the problem of how to bring this to bear on the matter at hand.

When you have an open discussion, face-to-face, it has certain advantages because of the time factor. You get quick responses, you have an immediate exchange of opinions. On the other hand, you are also producing a great deal of what is called in information theory, 'noise'. You are producing a lot of noise in the system because false or erroneous or irrelevant information is being generated. It becomes a question then of finding the optimum, of on the one hand saving time, which is clearly an important factor when you have a face-to-face situation, and not introducing too much irrelevant or even wrong information that might affect the judgment.

So one has to seek methods of combining the best of both worlds. A lot of experimentation is going on in this field and a lot more has to be carried out. I mentioned one possible sort of mixture of the two methods and in fact in a small way we will use it here - something we sometimes refer to privately as a 'mini-Delphi' - where you do have people sitting together in a face-to-face situation, where you are however asking each person independently to write down his answer to a particular question as we have done here in filling out a little questionnaire, so that each person in the group has the same right to state his opinion. You then compare the answers and you might have an open debate, but then it is important that at the end of the debate each person once more answer the question independently, having listened to the arguments brought forward by his colleagues on the panel.

This becomes particularly important when you have the kind of mixed panel where some people might be afraid to speak up. It is particularly clear in a situation where people of different ranks are participating in conversation. This is obviously the case in a military organization. You might have it in a ministry where it might be very important to bring in some of the younger people at the working level, to hear their opinions, but they might hesitate to speak out against the opinion that has just been expressed by the Minister or one of the directors.

Consequently, we thought of a process which would not eliminate debate but which would produce something like an anonymous debate. This led us to a procedure of using a sequence of questionnaires, where the second and third, and maybe fourth questionnaires, or however many you have, would contain a certain amount of feedback information for the participants about the outcome of the preceding round, possibly about the specific opinions that had been presented by the participants in the preceding round, without however identifying them.

With regard to the problem of leadership, I do not think one should view the Delphi technique as a replacement for decision-making, it is an aid in decision-making. Remember that the Delphi technique is simply one means of collecting expert opinions. A wise decision-maker will consult with specialists in the relevant fields in the usual manner, either listening to them one by one or listening to a discussion that goes on among them, and then will form his own judgment. Or he can use the Delphi method, arriving at some consensus, if possible, of the group of experts he is consulting. But he will still, just as in any other method of using experts, reserve the decision to himself. He may just say "well, these experts are all wrong and I am going to do it differently".

This method is not, therefore, a replacement of a decision-making process. It is merely an aid, it is a way of processing the information that is in the heads of experts, bringing this information in the most concise manner to the attention of the person who finally has to make the decision. He can take it or leave it. He can make the decision using that kind of advice or he can disregard it.

As to practical consideration. I understand that when you are faced with daily decisions in education, you are concerned over how to improve the system now and you cannot worry about what kind of fancy gadgets you might have 10 years from now, or 20 years from now. However, I think that while it is clear that you are concerned with decisions on education that have to be made now or in the immediate future, you want this education to be useful to the people you are putting through the educational system. Now these youngsters are going to live out their lives very largely in the twenty-first century and therefore it is important that in planning education today we ask ourselves what is the kind of life, what is the kind of environment in which these children will live out their lives?

Any educational reforms that we are contemplating now will probably not be implemented for several years and the children who are put through this system are probably just about now being born or are a few years old only, and therefore they will be about 30 years old by the year 2000. We want to be sure that this education still makes sense to them when they are 30, 40, 50 years old and so we have to ask ourselves, if we want to make sense of our educational planning, what will the world be like in the early part of the twenty-first century when the environment will be very different. There will be fundamental changes, particularly in the developing countries, by that time, and so the educational system that we are now planning, not the educational system we are planning for the twenty-first century, but the present educational system, the educational system for the seventies, should take into account some image of what the world probably will look like in the early part of the twenty-first century. I think it makes sense to ask these questions.

The question of how to choose the experts is being raised all the time. We ourselves in our own Delphi studies are confronted with that problem constantly. There is no simple answer. I cannot pretend that we have a ready-made method for choosing experts. One thing one should remember is that a Delphi survey is not a public opinion survey so it is not important that you have all views, proportionally represented. What is important is that all views are somehow represented.

Now, in many cases, when you are planning in a very complex area such as education, there are clearly many different areas that are relevant. You would want to bring in expert knowledge from the areas of sociology, of education itself, of course, and of perhaps the urban and rural political scene. If you are concerned with problems of cost of equipment and facilities, you might want to bring in some experts on the problems of costing in these areas, you might include architects or designers of equipment and so on. You have to ask yourself what are the relevant areas that must be included and first make a check-list of the areas that ought to be represented. Very often, you might be able to find people who are expert in more than one of the areas that you have listed. They might be the preferred respondents because that will help you keep the number of people down whom you have to consult.

To identify specifically, not just the areas, but the people you want to use, we found one device quite helpful. We identify first one or two or three people who are clearly very knowledgeable in the areas of concern. We ask them to participate and moreover to give the names of other people whom they regard highly, not necessarily people who are in agreement with them - you might even explicitly ask them who are the people who are particularly in disagreement but whose judgment ought to be heard. Then we ask these people in turn whether they will participate and ask them for additional names of people who ought to be included. We soon find that the same names begin to recur, which is an indication that those are the ones who ought to be included in the panel.

There is the question of how many persons ought to be included. This depends very much on the subject area. In dealing with a very narrow subject matter - for example, with the future of computers - you will probably find that by the time you have consulted eight or ten people, you get the same opinions over and over again. The same might be true regarding future of space exploration. On the other hand, in dealing with a complex subject that has many facets, such as education, you clearly need experts in many different fields, and you might very well find that in order to have each area and each point of view represented properly, you may need as many as 50 people. In that case, however, if you are submitting a questionnaire to, say, 50 people, on many aspects of a particular question - say educational planning - you would want to make quite sure that the respondents are not required to answer every question. It is best in that case to ask the respondents themselves to select those particular questions out of the many that you may ask in your questionnaire where they feel they can really bring some specialized knowledge to bear on the problem, so that you are not getting your few real expert opinions mixed in with a lot of opinions that are essentially lay opinions. In addition, you would not want to have as many as 50 responses to each particular question because the process itself then becomes clogged - it is just much too much work to do it and it is unnecessary because you are bound to get the same opinions repeated over and over again, the marginal returns begin to diminish very shortly after a while.

I think it might be most practical if I would refer to a very simple example to show you how the method works.

This is an example of the first major study forecast in the field of technology and science, conducted around 1963. The study has been published since in several places and you may have seen it before. Among the questions that were asked of a group of people who were presumably experts in the field of computers and computer technology was this particular one: When will a machine become available that can comprehend standard I.Q. (Intelligence Quotient) tests and score above 150? We had quite a distribution of answers. The answers ranged from 1980 - remember this question was posed in 1963 - to the year 2100 and there were two people who said it would never happen. There were altogether some 15 respondents in this particular case. Now, to describe the distribution in shorthand form, we singled out the median of these responses and the so-called quartiles or 25 per cent marks. The spread was quite sizeable and the median value was at 2020.

We next sent another questionnaire to these same respondents and told them precisely what I was just saying, namely that the result of the first one had been that the median was at 2020 and the quartiles at the year 2000 and the year 2100. We now asked the respondents to think about this once more and revise their answer if they wished.

However, if the new answer they now supplied was beyond the upper quartile, would they please briefly state their reason why they thought it would happen so much later or perhaps never happen in contradiction to what clearly was the majority of opinions. Similarly, if they now turned in an answer below the lower quartile, would they give also a reason why they thought it would happen that much sooner than the majority seemed to think. We can almost anticipate the result. There is a condensation, a shrinkage of the interval because those people who had a relatively extreme opinion had not been so very sure of it anyway and in fact were unable to justify it now by giving a reason. They are more or less forced toward the centre toward what had been the median, whereas a few who really thought they knew what they were talking about stuck with their values, but the result is now that what is called the inter-quartile range, which had been from 2000 to 2100 years, is now shrunk from 1990 to 2050, which allows 60 years only. That is some of the measure of the spread of the opinions, incidentally also the median moved to a somewhat earlier date.

Now, having received these responses, including some reasons and some arguments as to why the value should be the earlier or later, we now went to the third one where we told the respondents again what the new median was, what the inter-quartile range now was, and we gave them also a summary of the opinions that had been given as to why the date should be earlier, as some thought, or why it should be later, as some others thought. There is the element of a debate going on, but it is completely anonymous.

We again asked the respondents to reconsider and to take into consideration the reasons that had been offered to see if in their opinion these reasons were valid. If someone now thought that, well, the reason presented for an earlier value was really rather convincing, he might move his date to an earlier point on the scale, and similarly in the reverse direction. Now if someone gave a response which lay outside the new inter-quartile range, we asked him to state why he found the reasons that had been given for the opposing point of view unconvincing. Thus, someone who now gave a response on the high side was asked for a critique of the reasons that had been given for lower points, and similarly respondents who gave lower values were asked to say why they found the reasons given for the upper values unconvincing. In this way, counter-arguments were elicited from the respondents.

Finally, in a fourth round, the new inter-quartile range, which in this case happened to be smaller again, was communicated back to the respondents, with the new median value. The counter-arguments were fed back and the respondents were told to reconsider for the last time, taking both the arguments and counter-arguments into consideration, and to give their final assessment of where the value might be now. It finally turned out that we had a very narrow inter-quartile range from 1984 to the year 2000, with the median at 1990. That value 1990 was accepted as the nearest thing to a consensus among the group. Of course there was not a consensus but at least it was much closer to a consensus than it had been originally, although there was one holdout who still thought it would never happen, and someone else who had switched to an earlier value than he had first given.

Now, I want to state that you do not always get this beautiful convergence. This certainly cannot be hoped for. All one can say is that statistically speaking in a large number of cases - in the majority of cases - you get two things: you get a convergence to a narrower range of opinions, and this is of course the more important thing perhaps, you get a convergence toward the true value. You might after all get convergence but away from the true value, which would not do you any good at all. But by and large it seems to be the case - the majority of cases at least - that you have this kind of convergence of views and convergence in the right direction.

Now, there are a number of things which can be said about this method, somewhat on the negative side. In particular, there are many cases where you do not get any convergence and you might even get a situation where the views diverge. The more people discuss the issues, the more they seem to become aware of some diametrically opposite points of view, which throws their views apart and you see something like two different schools developing about a particular issue It is very difficult in that case to induce convergence, and it might be clear evidence that we just do not know enough about the situation, that it is pretty much guesswork, except for the following. We have observed that quite often when there seems to be no convergence or there seems to be even a divergence of views, it is not so much because people disagree in any factual sense but it is a semantic problem. It very often means that there are somehow two different interpretations of the question that had been asked that maybe the questioners had not been aware of in the first place. As you go through this process you begin to find out that something was wrong with the wording, that people gave a different interpretation to the same question, hence the divergence of views.

In running a Delphi study it is always a good idea, therefore, to encourage the participants to suggest a rewording or a reformulation of any questions they find in any way ambiguous or ambiguously worded. It often leads you to detect some uncertainties in the interpretation that the questioner had not been aware of.

Let me now present some results that came out of a study which was a follow-up to this one, a study that was carried out by the Institute for the Future, also concerned with technological and scientific forecasts. I have selected from it those items which seem to me most relevant to the problems of education.

I have listed the following events which in some cases have an obvious connexion with education and others a somewhat indirect connexion, but I think you will be aware of what the connexion is: development of economical mass-administered contraceptive agents, availability of cheap non-narcotic drugs for the purpose of producing specific changes in personality characteristics, development of immunizing agents which can protect against most bacterial and viral diseases, laboratory demonstration of artificial generation of protein for food through in-vitro cellular processes, demonstration of techniques by which the sex of babies may be chosen with 90 per cent certainty.

All these events were forecast to take place by around 1980 - in other words within 10 years. By around 1990, according to the experts who participated, we may add the following four items: widespread use of individual portable two-way telephones, availability of a computer which comprehends standard I.Q. tests and scores about 150 (you note that the value still is about 1990 as it had been estimated to being in 1963) the new study confirmed the development of techniques which can increase the world arable acreage by 50 per cent without prohibitive cost penalties, and specific knowledge of how to stimulate cognitive growth to maximal ability of pre-school children. Then sometime in the nineties, an additional item: widespread installation of agri-industrial complexes based on the use of breeder reactors. Then by 2000, the feasibility of using drugs to raise the level of intelligence other than as dietary supplements and not in the sense of only temporarily raising the level of our perception.

The Delphi method has been used perhaps most frequently for the purpose of forecasting, but forecasts are not the only application of Delphi. It can be used in any situation where you wish to, or you find it advisable to, refer to expert opinions. Sometimes, for example, you may be concerned with resolving moral or ethical issues. You are concerned with questions of preference. For example, at the highest governmental level you may be faced with the problem of whether more money should be allocated to education and less, let us say, to housing, or vice-versa. There is no objective way of finding out which one ought to do but one can state preferences there. One thing may favour some segment of the population rather than another and this becomes a moral question if you really come right down to it, when your decision has to be made. In situations of this kind you may want to consult expert opinion, not so much because this becomes a matter of a majority rule - particularly not a majority among the experts you happen to consult - but because through the Delphi process you might be able to crystalize the reasons for one or the other choice with which the decision-maker is faced. Once the decision-maker sees what the reasons are for one choice or the opposite choice, he may find it much easier to make what he considers the right decision, because he now begins to see more clearly what the consequences are of the alternative options that he has at his disposal. So, it is in situations of that kind where Delphi might be just as important, if not more so, than for making forecasts.

Similarly, to mention another example, a decision-making process might simply involve some estimate of what is now the case or what now ought to be done in a given situation. Let us say, in the case of a corporation, the management may want to decide whether to concentrate on the production of one type of goods or another and they may want to consult their specialists in the field as to what the public is now demanding - type A or type B of goods - and it may then become a question of allocating resources to one or the other activity. So the choice between two alternative decisions that may have to be made now might be decided through the use of expertise and via the Delphi method.

What I wish to do now is to involve you in a planning exercise concerned with education - with long-range educational planning in the developing countries. This will be a simulated planning exercise. We are going to pretend that we will plan for developing countries and do this according to a set procedure. In the course of this, I will be collecting from you written responses, that is some numbers I will be asking you to write on sheets of paper that have been distributed.

The point of this, of course, is to give you a demonstration of how one can use simulated planning and, in the course of it, the Delphi method in order to arrive at some decisions by a group.

Originally, in the pure form of the Delphi method which I have described earlier, you proceed entirely by questionnaires which are sent through the mail. Nobody knows who is participating except possibly at the very end but no-one's opinion is ever identified with him. We cannot quite preserve anonymity in a group like this, to the same extent at least. But we can at least get independent influence from each of you who is participating. I will tell you what the distribution of responses is but then at some stage I may ask you to engage in a little discussion to see if we can somehow come to a better agreement if there is a wide dispersion of views. We might want just to air the reasons for a low or high opinion on some particular issue out in the open. At that point, anonymity is lost but we get a much faster process. Normally, the Delphi procedure, if you go through the mail, sometimes with four questionnaires, might take many months. We might here go through some such procedure in a matter of an hour.

Again, if I may digress for another moment before we get started with this exercise, I think that one day not so very far away, we will reach a point to which Mr. Davidson alludes in his paper where the Delphi procedure might be completely automated. Imagine, for example, that each of you had in front of him on the table a little input device that feeds into a computer, that is something like a little typewriter, where he could type his opinion instead of speaking out loud. We might then have everybody who wants to state his opinion on some particular issue do so. The computer would automatically collate these opinions and, display them in front of you, so you could all see them but you would not know who represented which particular opinion. Thus you would have anonymity restored and yet experience a very fast procedure of really anonymous debate in the presence of one another. Of course once you go to the point where you have a computer console in front of you, there is no longer any need to sit in the same room. You could sit at your usual desks all over the world in conference through remote control. You would feed your opinions into a computer, the answers would come back to you almost instantaneously (or at least within minutes or hours, instead of many weeks) and one could run through a complete, and possibly very sophisticated, Delphi analysis through such a computer network. I refer to it as a D-net, in a matter of at most a few hours. You might in this way literally bring to bear the informed opinions of the best people all over the world, 'best' in the sense of the best experts you could find in a particular field. Now this may sound somewhat fantastic but if I may make a personal forecast, I think we will be very close to that situation in about 10 years. It is not science fiction any more - it is something which most of us will be participating in in some form or other.

Editor's note

Following Mr. Helmer's presentation and discussion, he and the experts proceeded to undertake a simulated Delphi exercise. We note that it was simulated in view of the following:

- the exercise did not relate to a specific country, hence no precise data were given,
- the experts met together in a single room, rather than separately. They were, of course, asked to respond individually and without conferring with one another,
- there was a distinct pressure of time rather than allowing each expert to consider at length what his response would be,
- several of the questionnaires might have been re-distributed, modified, and distributed again, time limits prevented this,
- the discussions of the problem were intermingled with discussions about the methodology itself.

The problem was that of evaluating a 'known' developing country school system, considering a number of proposals for reform, suggesting budgetary allocations for preferred reforms, and estimating the effects upon the school system within five years.

The exercise in which the experts participated consisted of the following steps.

(1) To indicate how satisfactory (or unsatisfactory) is a given (the expert's own) educational system in each of eight respects: see questionnaire No.
Thus, as to pupils (quantity), how many of those who should be enrolled, are enrolled and in attendance in the public and private elementary schools? As to pupils (quality), what is this state of readiness for learning, their motivation, their freedom from home labour to be interested in and able to do school work.
As to teachers, are there enough teachers? What is the quality of the teachers now in the schools?

Questionnaire No.1

	Quality of Education							
	Pupils		Teachers					
	Quantity	Quality	Quantity	Quality	Facilities	Equipment	Curricula	Administration
Satisfactoriness Index Medians:	60	50	55	40	40	30	40	30

Rate each of these eight aspects of the quality of education in your country on a scale from 0 to 100, where '0' represents a condition of utter catastrophe and '100' represents a condition of utter perfection.

Similar ratings should be made regarding school facilities (buildings, sites, classrooms, etc.), equipment in the schools, curricula (including teaching methods and materials), and administration.

The figures shown represent the 'satisfactoriness index' as the median response of the experts for each aspect.

(2) To study a list of reform measures which have been proposed and to add to the given list additional measures which are considered by each expert to be potentially useful. See work sheet No.1. Items 21 through 32 were proposed in open discussion of the experts. Work sheet No.1 also demonstrates the feasibility of linking proposed reform measures to each of the quality aspects. Thus, experts in a full-scale Delphi activity might be asked to indicate (within the columns) their estimate of the contribution that may be made by each proposal toward improving each of the aspects. Such indications might take the form of + 0, -, or of scaled opinions of impact from 1 (low) to 5 (high) etc.

Work Sheet No.1

	Satisfactoriness Index	Quality of Education								
		Pupils		Teachers		Facilities	Equipment	Curricula	Administration	Importance Rating
		Quantity	Quality	Quantity	Quality					
	Reform Measures	60	50	55	40	40	30	40	30	
1	National teacher education programme									
2	Construction of a 'school map'									
3	Introduction of public educational TV									
4	Production and use of filmed lectures									
5	Large-scale use of teaching machines									
6	Installing one or more model schools									
7	National education performance standards									
8	Introduction of free school lunches									
9	Non-professional teaching aides									
10	Substantial raises in teachers' pay									
11	Abolishment of rigid grade segregation									
12	Allowances for different learning speed									
13	Occasional teaching by older children									
14	Information acquisition at lower grades									
15	Use of gaming as a teaching device									
16	Real-life problem solving courses									
17	Mobile educational service in remote areas									
18	Public boarding schools									
19	Expansion and improvement of plant facilities									
20	Monetary compensation for achievement									
21	Organization of school guidance									
22	Educational radio									
23	Training programme for school administrators									
24	Incentive fringe pay									
25	Co-ordination with parent education									
26	Grading of teachers by pupils									
27	Better age/grade correlations									
28	Pre-school programmes									
29	Automatic pupil promotion									
30	Quality control of the educational system									
31	Educational research									
32	Assessment of system goals									

(3) To reflect upon the importance of all the suggested reform measures and rate each one. See questionnaire No.2. This form was used by each expert to indicate individual ratings of importance.

Questionnaire No.2

No.	Rating
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
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21	
22	
23	
24	
25	
26	
27	
28	
29	
30	
31	
32	

Rate each measure on a scale from 5 to 1, where

'5'
stands for
'most important'

and

'1'
stands for
'least important'

(4) To compile all the ratings made, establish a median score for each reform measure and determine which measure received such low scores as to be omitted. See questionnaire No.3. This form was used by each expert to rate the remaining 18 proposed reform measures.
Medians of expert ratings were determined for the suggested reform measures. The highest 18 are shown.

Questionnaire No.3

	No.	Rating
*	1	4.6
*	2	3.4
	6	2.8
*	7	3.8
	12	3.2
	15	2.4
*	16	3.6
*	19	3.2
	20	2.4
*	21	3.2
	22	2.8
*	23	3.6
	24	3.0
	27	2.6
	29	3.2
*	30	4.2
*	31	3.6
*	32	3.8

(Medians of experts' ratings)

Rate each measure on a scale from 5 to 1, where

'5'
stands for
'most important'

and

'1'
stands for
'least important'

using each of the numbers from 5 to 1 exactly four times

* Selected as the 10 highest priority measures

(5) To consider financial allocations to the remaining reform proposals in response to the following question.
"Suppose your country were given an extra one dollar per capita each year for the next five years to improve primary education, what percentage of that amount would you allocate to each of the 10 selected measures?" See work sheet No.2. Allocation to the remaining 10 measures

were proposed individually and the medians for the group computed. This exercise repeated further would produce 'second' and 'final' allocations.

(6) Given the budget allocated to each measure, what would be the over-all beneficial effect of each measure (on a scale from 1 to 5)? Questionnaire No.3 (blank) was used again and median responses were computed.

(7) Given the programme of reform measures selected and the budgets allocated to each measure, and accepting the median satisfaction levels determined in Step 1, what would be the new satisfaction levels attained as a result of implementing that programme of measures? Questionnaire No.1 was re-used in this context. The median responses of the experts are now noted just below the 'original' index on Work sheet No.2.

It was possible to see, following this simulated exercise of a Delphi operation, how expert opinions may be used in evaluating educational conditions, in considering proposals for reform, in determining priorities among proposals for the guidance of policy-makers, in suggesting budgetary allocations, and in estimating the future effectiveness of the reform proposals if they should be implemented.

It seems evident that the Delphi method has strong potential as a supplementary aid and guidance for planners and decision-makers. Delphi procedures seem to be applicable also, in determining objectives and priorities in a PPB system as well as in providing useful inputs for PERT network development.

Work Sheet No.2

	First allo-cation	Second allo-cation	Final allo-cation	Over-all effect	Reform Measures	Pupils		Teachers		Facilities	Equipment	Curricula	Administration
						Quantity	Quality	Quantity	Quality				
					Original satisfactoriness index:	60	50	55	40	40	30	40	30
					New satisfactoriness index, due to reforms:								
1	20				National teacher education programme								
2	5				Construction of a 'school map'								
7	10				National educational performance standards								
15	5				Real-life problem solving courses								
19	20				Improved plant and facilities								
21	10				Organization of school guidance								
23	10				Training for administrators								
30	5				Quality control for the educational system								
31	15				Educational research								
32	0				Assessment of system goals								

Work Sheet No.2

	First allocation	Second allocation	Final allocation	Overall effect	Reform Measures	Pupils		Teachers		Facilities	Equipment	Curricula	Administration
						Quantity	Quality	Quantity	Quality				
					Original satisfactoriness index:	60	50	55	40	40	30	40	30
					New satisfactoriness index, due to reforms:								
1			20	5	National teacher education programme								
2			5	4	Construction of a 'school map'								
7			10	3	National educational performance standards								
16			5	1	Real-life problem solving courses								
19			20	4	Improved plant and facilities								
21			10	2	Organization of school guidance								
23			10	5	Training for administrators								
30			5	3	Quality control for the educational system								
31			15	4	Educational research								
32			0	-	Assessment of system goals								

Work Sheet No.2

	First allo-cation	Second allo-cation	Final allo-cation	Over-all effect	Reform Measures	Pupils		Teachers		Facilities	Equipment	Curricula	Administration
						Quantity	Quality	Quantity	Quality				
					Original satisfactoriness index:	60	50	55	40	40	30	40	30
					New satisfactoriness index, due to reforms:	70	50	70	60	60	50	50	50
1			20	5	National teacher education programme								
2			5	4	Construction of a 'school map'								
7			10	3	National educational performance standards								
16			5	1	Real-life problem solving courses								
19			20	4	Improved plant and facilities								
21			10	2	Organization of school guidance								
23			10	5	Training for administrators								
30			5	3	Quality control for the educational system								
31			15	4	Educational research								
33			0	-	Assessment of system goals								

THE PRINCIPLES OF PERT

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INTRODUCTION

The PERT method (Programme Evaluation and Review Technique) is an auxiliary management method, an instrument in the hands of the manager for the planning and use of his resources to achieve a defined objective.

PERT has not been established to usurp the managerial function, but to help the manager discharge his function more effectively. The method does not run itself, on the contrary, it depends entirely on the skill of the manager in discovering and recognizing the problems.

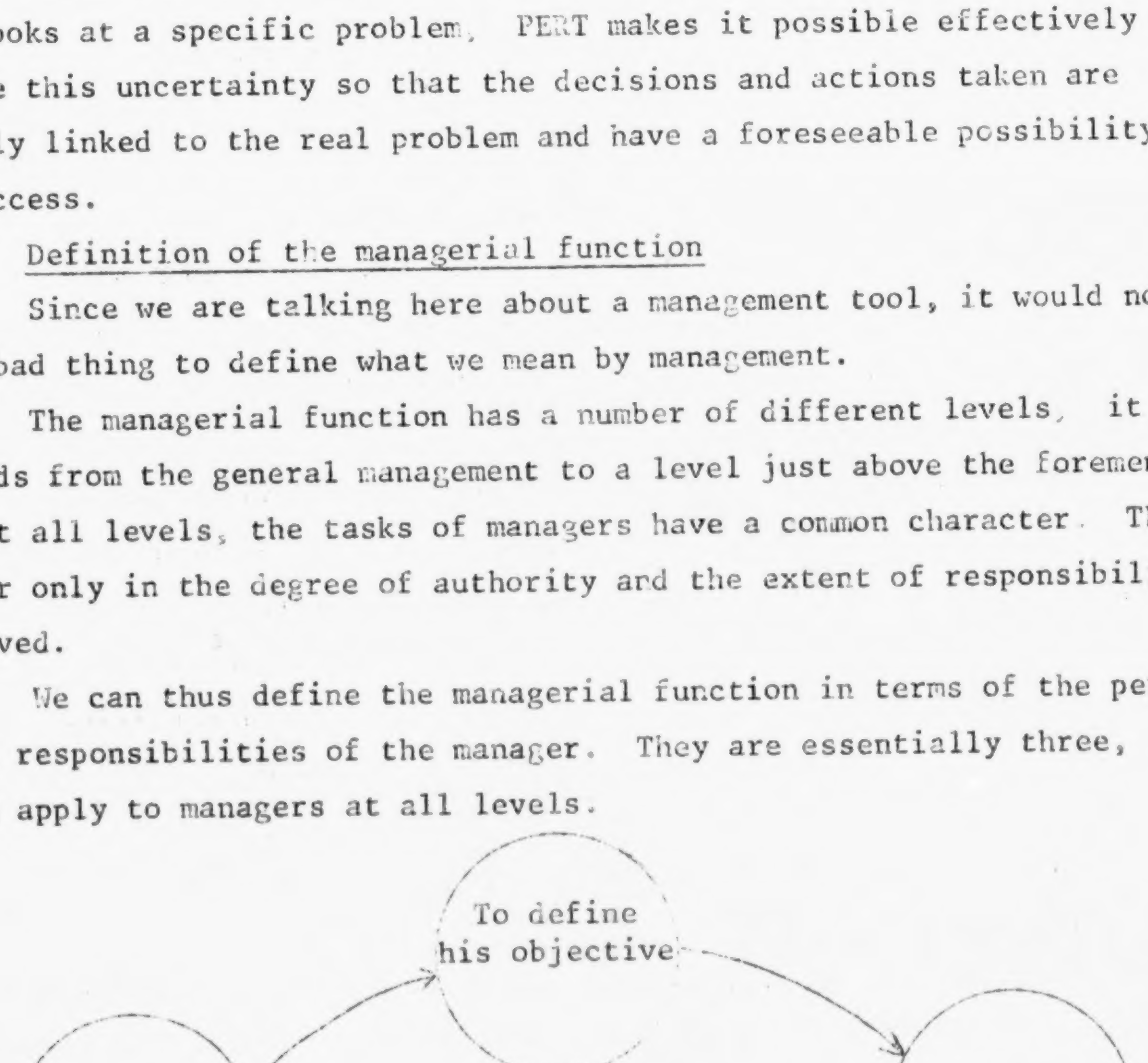
PERT does not solve problems, but shows them up in such a light that all the factors connected with the problems can be evaluated. It is rare for all the consequences of a management decision to be known at the moment when the decision is taken, uncertainty comes in whenever one looks at a specific problem, PERT makes it possible effectively to reduce this uncertainty so that the decisions and actions taken are closely linked to the real problem and have a foreseeable possibility of success.

Definition of the managerial function

Since we are talking here about a management tool, it would not be a bad thing to define what we mean by management.

The managerial function has a number of different levels, it extends from the general management to a level just above the foremen. But at all levels, the tasks of managers have a common character. They differ only in the degree of authority and the extent of responsibility involved.

We can thus define the managerial function in terms of the personal responsibilities of the manager. They are essentially three, which apply to managers at all levels.



First and foremost, the manager must choose or define a specific aim, his objective. Next, he must organize the available resources with the aid of a logical and detailed plan in time, to achieve his objective. Finally, in order to be able to deploy his resources and overcome unexpected conditions, he must be in a position to assess the state of progress at any given moment in the light of the over-all plan.

Since plans are always to some extent incomplete or imperfect, they generally have to be readjusted and the intermediate objectives have to be constantly reviewed.

The function of the manager, even stated in such simplified terms, is a complex responsibility marked by an ever present margin of uncertainty. This is particularly true when the objective set is unprecedented and the success of the plan cannot be guaranteed by experience. Even on familiar ground, the manager is still a prey to certain doubts. He can never predict with absolute certainty the execution of even the soundest plans. 'The best laid schemes of mice and men ...'

What he needs is a method which enables him to fix 'the best laid scheme', a way of arriving at a more precise forecast of success, a system which assembles first hand information on the progress of the project and sums it up.

The PERT system, Programme Evaluation and Review Technique, was worked out specially to help management in the fields where uncertainty might be fatal to effectiveness. The whole significance of the initials PERT involves the consideration of the fundamental functions of management. For the user, whatever his personal talent and intuition, PERT constitutes a tool of unequalled simplicity and value. It is not a tool which will do his job for him, but it is a tool which will increase his possibilities of effective action with the best information available.

The history of PERT

When the United States Navy undertook the project of atomic submarines armed with POLARIS rockets, it was the technical problems which first seemed the most serious challenge. But a few men - particularly Admiral Raborn, the Project Chief - were realistic enough to recognize that, without under-estimating the importance of the technical difficulties to be overcome, the problem of control and co-ordination was the major problem in such a vast project, unequalled even by the Manhattan Project (the achivement of the atom bomb).

These men assumed correctly that the resources, human skills and production capacity already existed in more than sufficient quantity and quality. In order to make the weapon operational at a reasonable cost and within the deadline set, the indispensable factor was the efficient management of the project. Some means had to be found of communicating with 250 main suppliers and more than 9,000 sub-contractors and to direct them in such a way that the efforts of all were co-ordinated with a view to the fastest rate of progress of the undertaking.

In co-operation with the Navy, the management consultants of the firm of Booz, Allen and Hamilton developed the fundamental ideas of the PERT method[1] as an instrument of planning, communication, control and reporting. The Navy regards PERT as the instrument which enabled the Polaris system to be made operational two years in advance of the originally scheduled date.

Such a spectacular success impressed not only the military command, but also a number of businessmen who introduced purely commercial applications of the method, ranging from production planning to public works and advertising.

Today, the method is in current use in all sectors of activity and all over the world. It is taught in engineering colleges. The beginner will find not only cases of application around him and an abundant literature, but also specialized services to advise and assist him in the management of projects. All computer manufacturers and business consultants have PERT calculation programmes available for users.

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[1] The official birthday of PERT is 27 January 1958. The method is based on earlier work by J.E. Kelley.

The advantages of PERT

The PERT method is not a panacea. It has its limitations, but the advantages which can be derived from its proper use are unrivalled. Although it was originally developed for use in major engineering projects, the system has proved effective and economic for small projects, even non-technical.

The advantages of PERT flow from its special way of looking at planning, which must be complete and logical. It is not merely a mechanism of organization, but also an incomparable means of communication which provides all levels of management with a common language.

The system brings out the relationships between the productive efforts within a project. It is therefore simple to rank the various problems according to their seriousness and to distinguish those which call for immediate attention and those which can be put off to a quieter moment.

The system can be made to operate as the automatic generator of situation reports and progress reports.

Since PERT describes the management plan in great detail, it is an ideal instrument for assigning responsibilities. It allows a considerable strengthening of the organizational structure. The danger nevertheless remains of an inept manager trying to use PERT as an instrument of coercion. The system is capable of it, but such a use would destroy all confidence, harden the natural resistance to change and this deterioration would deprive the manager of all the advantages which PERT offers to those who use it intelligently.

BASIC ELEMENTS OF THE NETWORK

1. The principles of constructing a network

The network

Definitions

The basis of the PERT system is the network (or chart, or arrow diagram) which is essentially the graphic representation of the logical structure of the project to be executed. The network represents an ordered series of actions which must all be performed in order to achieve a well defined objective. In simple terms, a network is a diagram of work sequences.

Geometrically, the network consists of two elements:

events: represented by a circle or any other closed figure, and

activities: represented by an arrow joining two events, following the direction of the lapse of time.

Activities and events are the two complementary aspects of each of the elementary and homogeneous units into which the over-all project is broken down.

The event is a stage or checkpoint in the plan. It defines the start or finish of one or more activities. The event is a point in time. The activity is a symbol of work in hand, of the consumption of resources and the expenditure of labour. An activity consumes time.

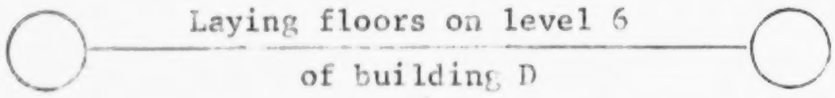
Rules of construction

Since it represents the logical structure of the whole of the project, the network must reflect the sequence of activities and events and the restraints imposed upon them (technical sequences, priorities, timing of supplies, etc.). The following rules ensure that these criteria and restraints are taken into account in plotting the network.

(a) Unambiguous definition of activities, an arrow represents one single activity only (Figure 1).

Figure 1

Definition of an activity

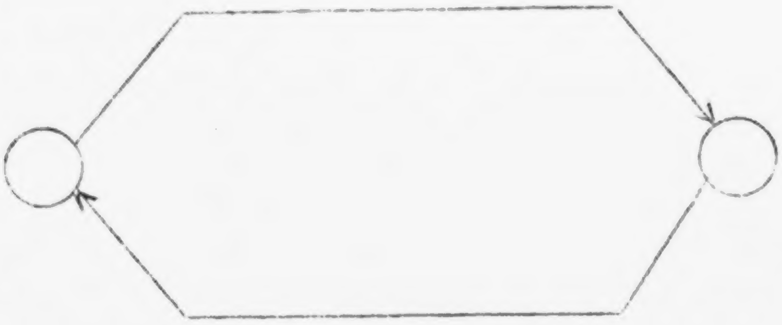


(b) Unambiguous numbering of events, each event is assigned a number and the number assigned to each event is different from that of all other events.

(c) Once an activity is completed there is no return. The network must not contain any 'loop' or feedback (Figure 2).

Figure 2

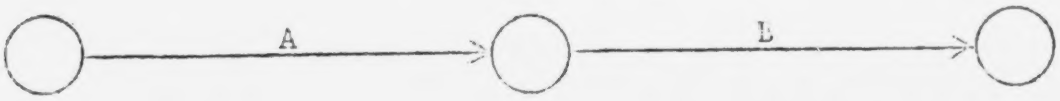
Loop (not acceptable in PERT)



(d) No activity can start until the preceding event or events have been completed (Figure 3)

Figure 3

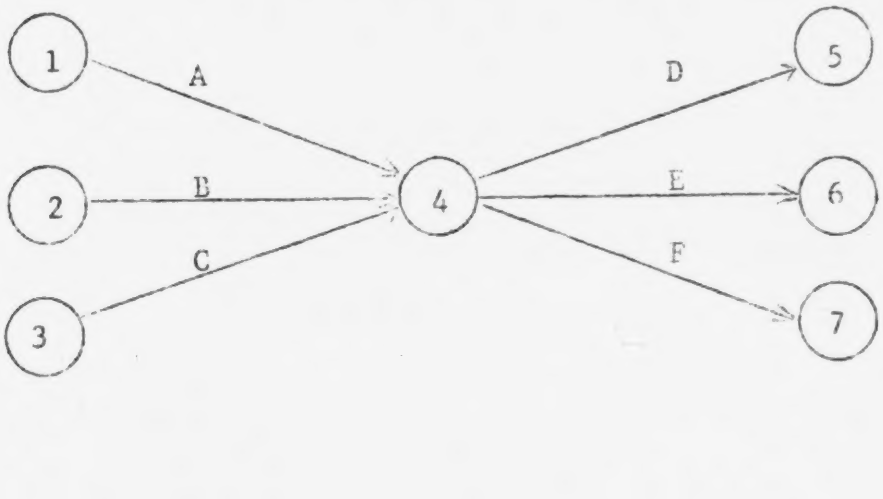
The rule of the dependence of activities



The chart shows that activity B cannot start until activity A is finished.

(e) All activities leading to an event have identical successors. All activities starting from an event have identical predecessors. It follows that a diagram such as that in Figure 4 expresses the complete dependence of the activities preceding and succeeding event 4.

Figure 4



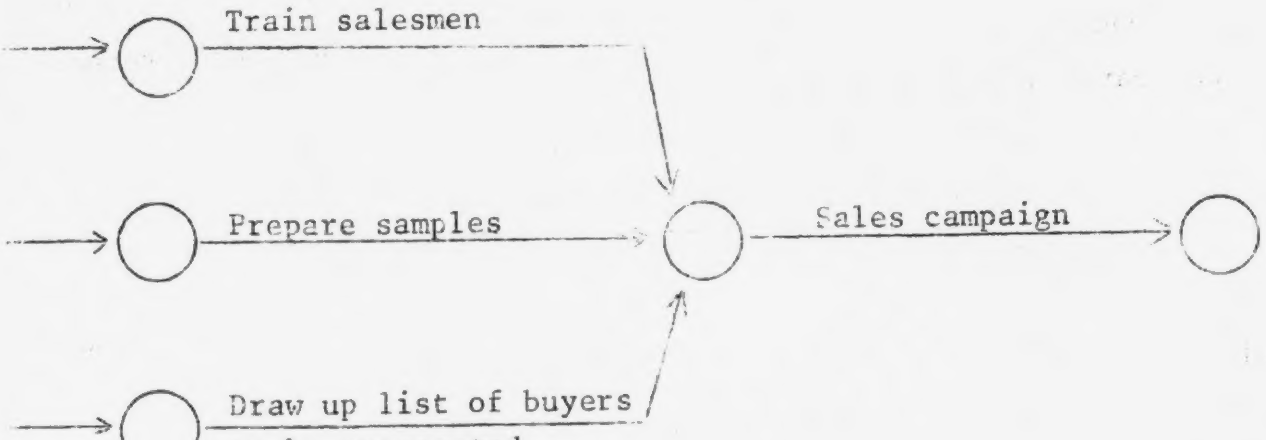
> Event 4 will be reached or achieved only when the three activities, A, B and C are completed. The three activities D, E and F cannot start until event 4 has been accomplished. It should be noted that these rules do not require the three activities D, E and F to start at the same instant, their preceding event (4) merely marks the limit after which they can be launched.

The events and activities form a time sequence through the network. The work must progress in orderly and strictly sequential fashion, from event to the activity, to the next event, to the next activity and so forth, according to the various restraints which effect the achievement.

Figure 5 illustrates these relations of dependency, showing that a sales campaign cannot start until the three events on which the campaign depends have been accomplished.

It should be noted that an event reflects the complete relation between predecessor activities and successor activities, so that the rules cited above may involve the definition of dummy activities which do not represent labour, but an essential dependence between events. We consider below the representation of these cases in the network.

Figure 5



Finally, it may be noted that an activity may represent a consumption of time, without corresponding to any labour proper, i.e. to any consumption of resources, examples, among others, are 'drying time' for paint or 'hardening time' for cement, etc.

Allowing for restraints

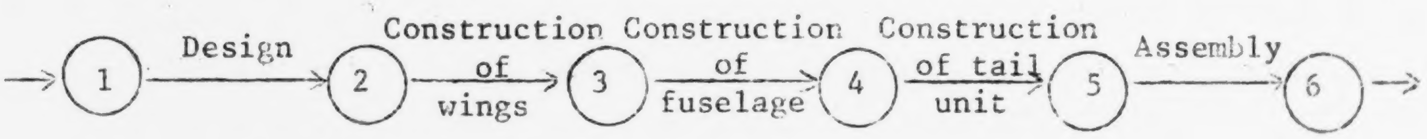
A piece of work may be described in terms of steady flow, parallel effort or serial effort. Parallel effort means that different activities proceed concurrently to converge finally on a point where the products of these parallel efforts are used. There is a danger that the results may not be perfectly adjusted, but the possible saving of time or the full employment of production capacities often justify this risk.

In contrast, activities may follow in series, as a result of inevitable dependency, or for reasons of economy or safety, or perhaps simply because of faulty planning.

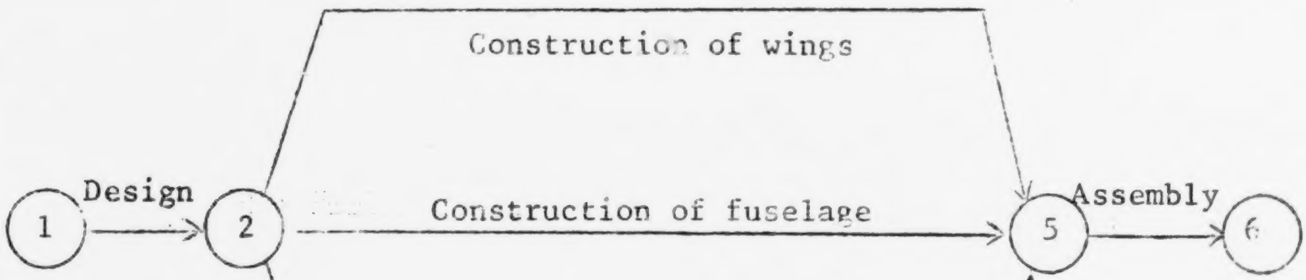
Figure 6 shows how a serial relation may be envisaged as a parallel relation.

Figure 6

Serial relation


1
Design
2
Construction of wings
3
Construction of fuselage
4
Construction of tail unit
5
Assembly
6

Parallel relation


1
Design
2
Construction of wings
Construction of fuselage
Construction of tail unit
5
Assembly
6

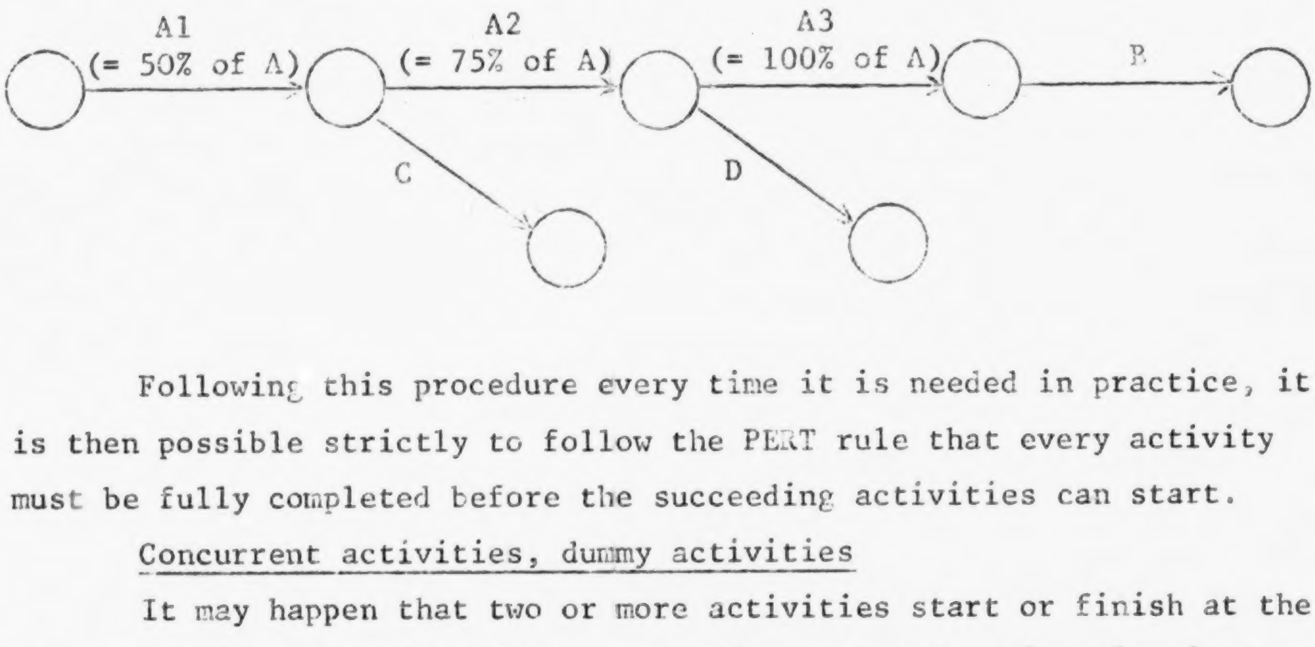
There are various rules which make it easy to allow for the restraints between activities on the network, the following cover the various situations of practical interest.

Composite activities

Let A be a predecessor activity of activity B. In practice there may be a certain overlap, so that B can start before the finish of A. More generally, a number of activities can start as soon as A reaches a certain percentage of its execution. In these circumstances, A is treated as a compound of several activities.

For example, (Figure 7) if activity C can start at 50 per cent of A, activity D at three quarters and activity B only when A is finished, A is treated as a compound of three activities A1, A2 and A3.

Figure 7



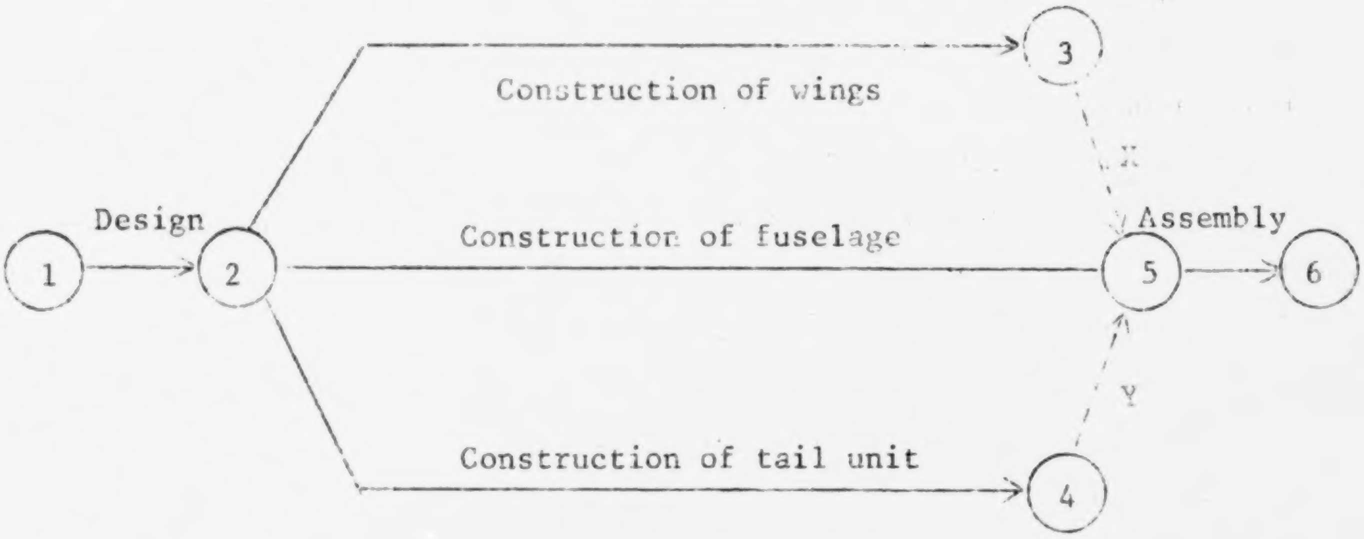
Following this procedure every time it is needed in practice, it is then possible strictly to follow the PERT rule that every activity must be fully completed before the succeeding activities can start.

Concurrent activities, dummy activities

It may happen that two or more activities start or finish at the same event in the project (see, e.g., Figure 6). The situation is ambiguous, since several activities are identified by the preceding and succeeding events, which, in this case are the same, (events 2 and 5). To eliminate this ambiguity it is assumed that all the activities except one are made up of two activities, the real activity, and another, known as a dummy activity, which is plotted by a dotted or discontinuous line.

The situation is illustrated by Figure 8 where two dummy tasks, X and Y have been introduced.

Figure 8

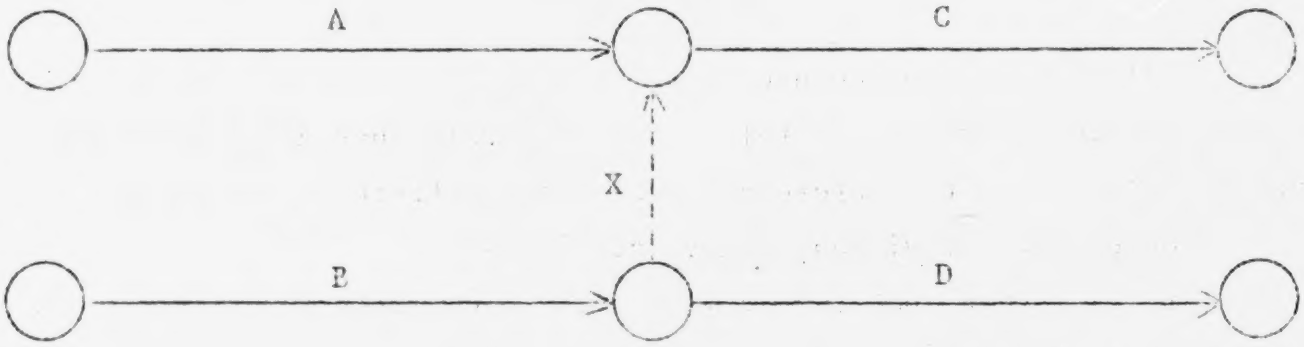

Design
Construction of wings
Construction of fuselage
Construction of tail unit
Assembly
X
Y
1
2
3
4
5
6

Dummy activities consume neither resources nor time. They merely reflect a logical restraint of dependency and avoid ambiguities, as in the following example.

Dependent and independent activities

It sometimes happens that a certain activity, C, follows two concurrent activities, A and B, but that B has a successor activity D, which does not succeed to A. A dummy activity X is then introduced, as shown in Figure 9. The interpretation is clear.

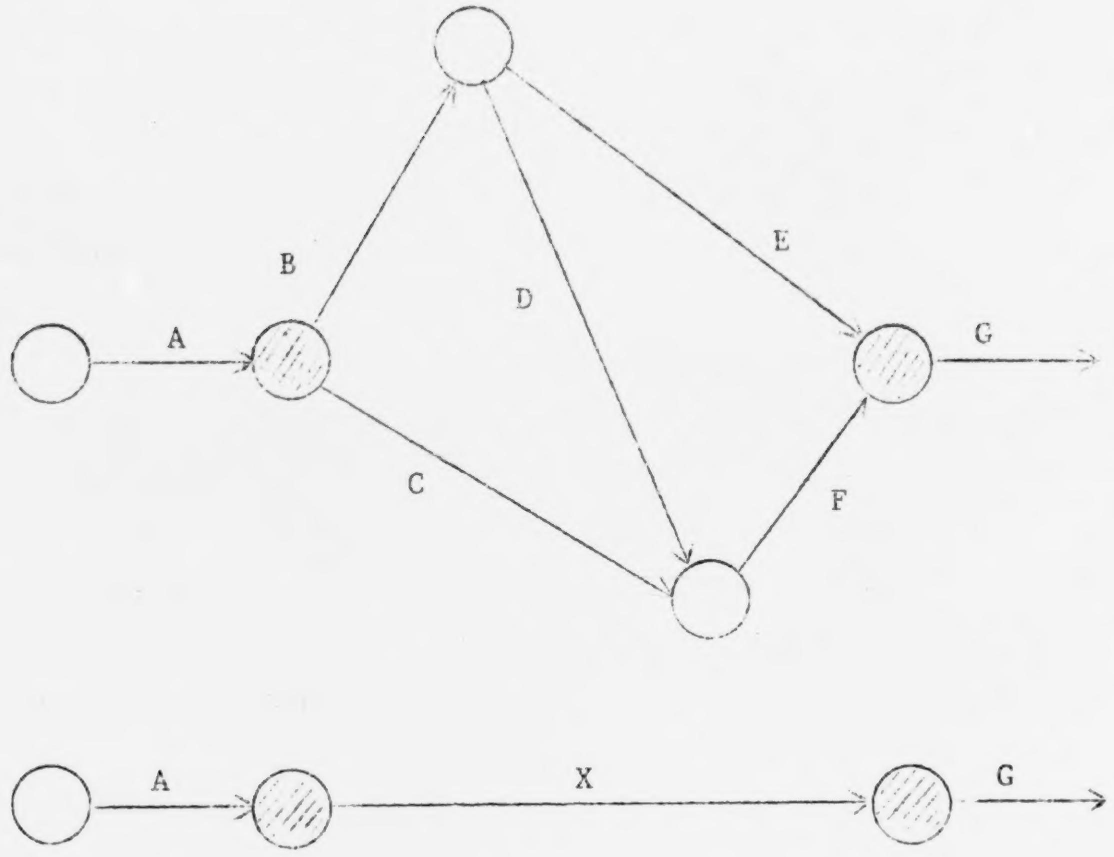
Figure 9



Aggregated activities

Sometimes, a group of activities can be treated as a single activity. This aggregation may be an advantage, particularly when all the activities of the group follow a certain order for technological reasons and form a little project of their own.

Figure 10



This procedure is useful both for constructing summary networks and in the technique of 'sub-networks' which is convenient for handling vast and complicated projects.

Methods of plotting the network

Before being able to start plotting the network, one must have a well defined objective. This will be the 'objective event' or 'end event', the last event in the network on which all paths converge. Plotting can then start according to one or other of the following methods.

Reverse plotting

This method consists in plotting the network in reverse, starting from the end event, asking the question at each event:

"What must be done immediately before achieving this event?"

The keyword is 'immediately', and the answer to this question specifies the factors on which each event depends. The arrows representing the activities are plotted, linking each event with those on which it depends. The same procedure is continued until reaching the logical start event from which all paths diverge.

Figure 11 shows the network, highly simplified for the sake of example, of the manufacture and delivery of a machine. By asking the question:

"What must be done immediately before delivery?"

we find that the machine must be packed and transported. The two necessary activities might be called 'book transportation (lorry, boat, etc.)' and 'packing'. Going back in time, we find that, before being packed, the machine must be ready for despatch (activity, 'inspection') and the packaging material must be available. In this way we go back to the start event, namely the signature of the contract.

Forward method

Starting with the present, or with the start event, we move forward, asking:

"What can be done immediately after achieving this event, what is the next activity?"

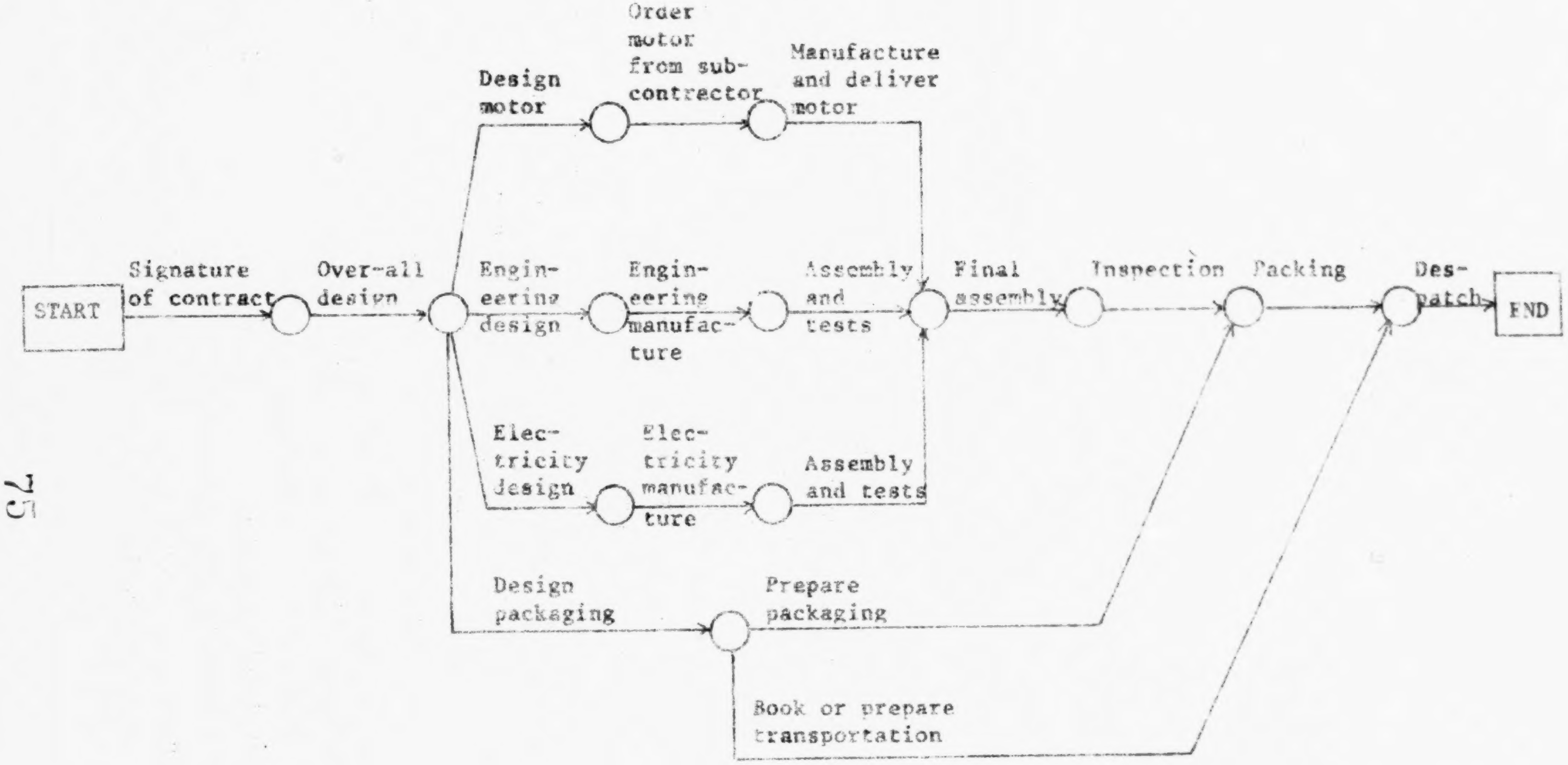
Working forward in this way, one generally gets a network whose events reflect the activities and checkpoints, as the manager conceives them. The reverse method will bring out the activities necessary for the plan, as the executants see them.

In practice, the two methods of plotting a network, reverse and forward, are complementary. The former defines the first event from which it is possible to start each activity, and the second the limit beyond which no progress can be made with the project until the activity is completed.

The list method

All known activities are listed. Each of them is then defined according as it precedes, succeeds or is parallel with other activities.

Figure 12


START
Signature of contract
Over-all design
Design motor
Order motor from sub-contractor
Manufacture and deliver motor
Engin-eering design
Engin-eering manufac-ture
Assembly and tests
Elec-tricity design
Elec-tricity manufac-ture
Assembly and tests
Final assembly
Inspection
Packing
Des-patch
END
Design packaging
Prepare packaging
Book or prepare transportation

The processing of this table allows a rapid outline of the network. It is then perfected by specifying the relations between activities by the procedure indicated on pages 67, 68 and 69.

The 'tree' method

This consists in drawing a graph of the project in the form of a 'decision tree'. The top level is the project itself, the finest level of the analysis is made up of work 'packages', which are detailed in the form of sub-projects or parts of the network. This procedure is described more precisely in connexion with the PERT/COST method.

* * *

None of these methods is specially superior to the others. It is a question of taste. Since you have to do your own planning and plot your own network, it is up to you to decide what you want to put in it and how you want to plot it.

2. The procedure for constructing a network

The network in the organization

Since most activities can be defined, one person should be made responsible for the work, either the person who actually does the work or the person under whose authority it is done. As we shall see below, it is highly necessary to assign responsibility for an activity. In any event, such an assignment has considerable advantages. It may be very difficult in practice to communicate the plan to all levels of an organization. The PERT network, drawn up in simple terms and understood by everybody, becomes an incomparable communication medium. Each individual or group responsible for a segment of the network can understand exactly what is wanted of him and the relation of his work to that of others. Changes of plan can be rapidly passed on, and their effect will be immediately understood by those involved.

Each network is determined by a certain group of addressees, a specific level of management. It reflects the degree of detail and the field of interest appropriate to that level. The 'degree of breakdown' can generally be determined by asking the question:

> "Can, or should, this manager influence this activity and act in this way?"

For example, a project engineer should not be concerned with the negotiation of a bank loan, or troubled with the details of nuts and bolts at workshop level. Considerations of this kind are outside his sphere, though no doubt these activities will be represented on diagrams at a higher or lower level. Furthermore, if he paid attention to them, the engineer might neglect his own responsibilities, thus involving a setback for the organization. PERT, when it is properly used, serves to demarcate responsibilities and to concentrate interest, thus strengthening the structure of the organization.

The construction phase

In the PERT method, the construction of the network is the main task. Most users consider that 80 to 90 per cent of the effort needed for PERT goes to constructing the network. This is reasonable, since correct and detailed planning is essential to efficient management. The advantages derived from PERT are proportionate to the quality of the network, thus compelling management to carry out complete planning.

During the plotting of the network, the chief executive should take an active part in the discussion. But, as the network will be outlined, corrected and discussed for a very long time, it is better that junior executives and technicians should not spend their time until the last stages of planning. The network is then plotted by each individual manager and the juniors he needs to compile the data, as well as an expert from the PERT group for the correct formulation of the data. In any event, a discussion and planning session should never consist of more than five or six people at a time.

A good deal of time will be spent in correcting, erasing and discussing before an acceptable network is produced. A network of 300 to 500 events may very well keep five people occupied for three weeks. Since the initial diagram is likely to be modified, it is better to plot it freehand on a table or on ordinary paper, leaving the use of a ruler and stencils for what might be called the 'final version' of the network.

No matter how much trouble is taken with the initial plotting, the network is never really finished. Like all plans it is a living, dynamic thing, which has to be adjusted to the unexpected events of the real world. As the programme progresses, errors of inadvertence will come to light, and accidents will happen the network will have to be modified to overcome the difficulties encountered and to provide correct planning once again.

The plotting of the network is a long and laborious task. The manager will often be unable to devote his full time to the initial plotting. He will join in the first general discussions and will summarize his intentions so that his juniors can work on the details. It is, however, important for him to supervise the plotting and to keep an eye on the development of the network as often as possible. Since he will control his own actions and those of his juniors during the execution of the plan, the network should represent his reasons and methods as precisely as possible.

Obviously, the more thorough the network and the more precise the planning, the better the chances of success. The advantage of the PERT method is not to cut down the time assigned to planning but to compel it to be properly thought out and detailed.

The degree of detail of the network

It is difficult to fix the precise point at which detailed planning becomes obsession with detail. But this point is never very far off, and it must be avoided by bearing in mind the optimum degree of analysis.

The level of analysis is an ill defined topic, but it is a critical factor in plotting a network. How can the essential part of a plan be distinguished from the less essential? How does the manager decide that an activity merits his own attention or that it can be left to a junior? The answer depends on the manager's personality and the nature of the problem. The question nevertheless arises on each event, and the answers must be uniform throughout the network.

With regard to the size of the network, it can be said that below 100 activities, the network is not very detailed, or the project is relatively small. A small network, with fewer than 100 activities will no doubt be perfectly well calculated and controlled manually. But above 300 activities, the operations become more complex and it is better that they should be computerized. A network of 1,000 activities is certainly beyond the capacity of the manager, who can no longer master the whole of the work. A major project, with a detailed network, usually exceeds 1,000 activities (the Polaris project involved 70,000 activities).

It is then impossible to represent a complex of this nature on a single network and the only practical method is to work out a multi-level network. The general management will use a network covering the whole of the project, including financing, personnel policy, research, manufacture, sales, etc. The responsibility for major sections of the general network is delegated to the next level of management, which, in turn, will give out 'sub-networks' representing its interests and aims. The responsibility for the activities on these charts will pass to the next level, and so on down the organization until the level of execution and supervision is reached.

This breakdown into a number of levels offers advantages which make PERT an even more effective instrument. In the first place, the objectives of the general management are easily understood and brought home to the whole of the organization. Secondly, the specifically technical analysis of the execution is assigned to the people who will be responsible for carrying it into practice.

Finally, as the activities progress reports are passed back up the chain, each level of management will receive the information it needs and no more.

THE INTRODUCTION OF TIME INTO THE NETWORK

1. Bases

So far, we have presented the PERT method as an instrument of planning, disregarding considerations of time. It is precisely one of the essential characteristics of PERT that it clearly separates the phase of the technical analysis of the project leading to the network from the phase of determining the execution timetable. Since the method is designed to forecast and control achievement dates in the light of estimated times, it is important to introduce time as a specific element of planning. This will make it possible to interpret the progress of the project in time, to calculate the achievement dates of events and of the whole project, and will bring out bottlenecks (critical activities), the under-employment of certain resources, the deadlines to be observed and any necessary corrections.

Sources of information

There must be the minimum possible distortion in the forecast timetable. That is why the source, definition and processing of information follow a strict procedure.

It may be recalled that, by definition, activities are time-consuming, whereas an event is merely a point in time. Time estimation is therefore always associated with an activity.

Since each activity is the responsibility of a specific individual, he is the person who is asked to estimate the time. It is obviously the person directly responsible for an activity who will have the most realistic ideas about the time needed to perform it. The acceptance of another source of information, even at a higher level of authority, will almost certainly induce error. Apart from these considerations, the encouragement of participation by all levels of management will not only help communications, but will certainly disclose latent defects in the plan.

Naturally, if there is more than one person qualified to make an estimate, all the different estimates will be taken and adjusted, whether by striking an average, or by discussion among these experts. It will also be helpful to consult any records which may exist as to the performance time of previous projects.

Estimating the time of activities

The activities which make up a network are generally of very diverse nature. Some relate to construction or manufacturing work, others to administrative or commercial operations, design, management, inspections, etc.

It is important, for the soundness of the forecast, that all the element times should be as uniform as possible. For this purpose, two rules should invariably be followed in estimating time.

Normal level of resources

Most frequently (for the exceptions, see the end of the section titled Rules of construction), an activity requires the availability of certain resources (labour, equipment, materials, fuel and power) and the resources available have a direct effect on the time of the activity.

It is then assumed that the volume of resources available to carry out the activity is the normal current level, as defined by usage.

It may be noted that certain methods similar to, or derived from, PERT, use the concepts of the minimum or maximum level of resources assigned to the activity. But the aim of the PERT method implies that the assumption of the normal level is the only reasonable one, and one which is capable of ensuring both a uniform estimate of the time of all activities and a realistic execution timetable for the project.

Availability of resources

The person responsible must estimate the time as if the activity in question were the only work to be done, and all his resources could be assigned to it. In other words, the normal level of resources must be deemed to be always available for each activity on the network.

The person responsible considers one activity only. It is absolutely essential for him to limit his reflection to this activity. By pinpointing the estimate in this way, the true time associated with the activity can be brought out, freed from all subjective attitudes and preconceived ideas.

When time estimates have been assembled for all the activities, it will be possible to form an opinion about the time of the whole, but not before.

Likewise, it is only after the event that any possible problems of resource availability will be considered. To introduce these problems from the start would inevitably distort the forecast. In this connexion, we may point out a mistake which is general among beginners, namely that of allowing in making time estimates (or even in the initial plotting of the network) for the fact that only one individual or machine will probably be available to carry out several concurrent activities of the network.

Special cases

The rules set out above make it possible to arrive at a correct estimate of the time of most activities.

But there are cases (design, research, etc.) where the estimator is faced with a difficult problem, arising out of various hazards, restraints outside his sphere of responsibility, or even uncertainty in the face of work for which there is no experience or possible reference available (technical innovation or artistic creation, etc.).

He then has to make an assessment, or even a guess, according to his skill and intuition.

A procedure has nevertheless been worked out which allows the estimator to indicate the foreseeable time of an activity and the degree of uncertainty he attaches to that indication.

The unit of time

Time may be expressed in any unit, provided that it is the same throughout the network and that it always relates to working time. These two reservations are warranted by the calculations we make below.

In practice, the unit is defined by the habits of each particular sector. It will be chosen for convenience of calculation and interpretation of results.

The working hour, day, week or month, etc., can be used. The Americans, who work a five-day week, often use the tenth of a week (a half-day).

2. The time schedule

Data

As we have seen, the network is the graphic representation of the logic adopted by the management to direct and control the execution of the plan. It is the first of the data we possess, the second being the time estimates assembled for the activities.

From these data, the time schedule can be constructed. The scheduling methods are outlined below, but at the outset, it is useful to set out, in a single table, the standard terms and symbols in the English and French languages.

Term	English language symbol	French language symbol
Expected time (durée)	te	d
Earliest allowable time (date de réalisation au plus tôt)	TE	TC
Latest allowable time (date de réalisation au plus tard)	TL	TL
Scheduled time (date de réalisation fixée)	TS	TF
Earliest start time (date de début au plus tôt)	ES	DC
Latest start time (date de début au plus tard)	LS	DL
Earliest finish time (date de fin au plus tôt)	EF	FC
Latest finish time (date de fin au plus tard)	LF	FL
Event slack time (marge d'une étape)	S	M
Total float of an activity (marge totale)	FT	MT
Free float (marge libre)	FF	ML
Independent float (marge indépendante)	FI	MI
Conditional float (marge conditionelle)	FC	MC

The calculation will enable us to define a double time schedule, 'earliest' and 'latest'.

Although there is no difference in principle, we shall proceed to calculate the dates of events and not of activities, and then give the rules for the transition from one to the other.

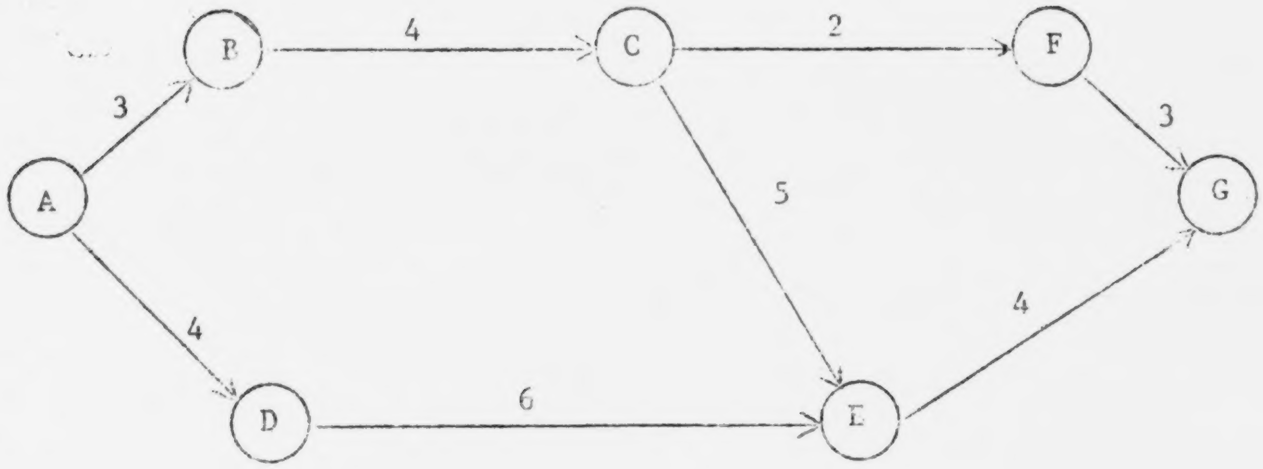
Earliest date of events

To explain the calculation, we shall take a very simple network (Figure 12) in which the events are identified by a letter and the expected time of the activity shown on each arrow.

The earliest date of an event is the date nearest to the start of the project on which it can be achieved in the light of the data.

The earliest date of an event is obtained by adding the expected times of the activities on the path leading from the start to the event in question.

Figure 12



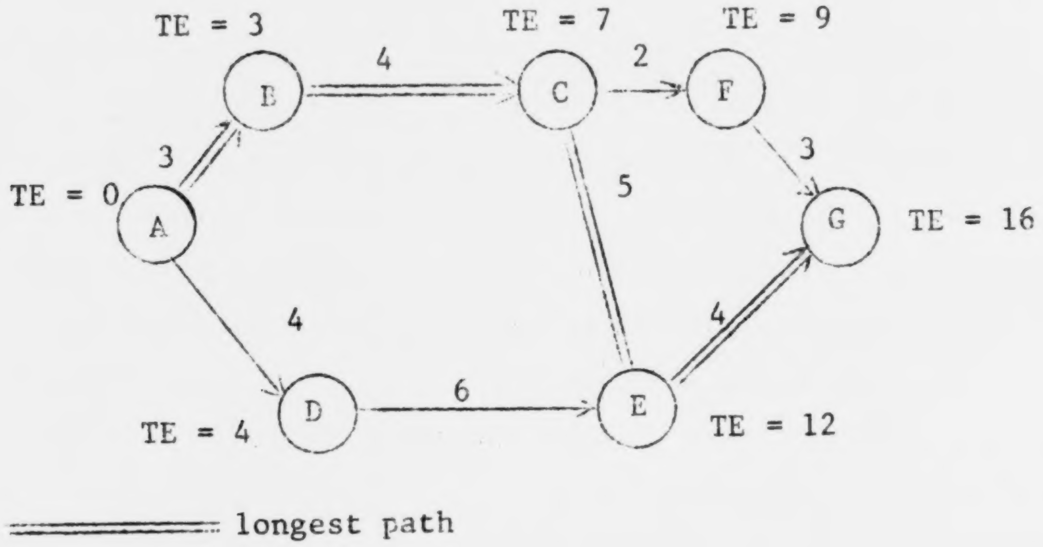
When several paths converge on the same event, the one with the longest total time is taken, this lapse of time being necessary to ensure the achievement of all the activities which converge on the event in question.

On the example in Figure 12, starting from the start event A at start date O, the earliest date of event B is 3 units. Following the same path, the date of reaching event C is equal to the earliest date of event B plus the expected time of the activity leading from event B to event C, or 3 + 4 = 7 units. Similarly, the date of reaching event D from the start event A is 4, and the date of reaching event E, by way of event D, is 4 + 6 = 10. There are two arrows leading to event E, DE and CE. We have already seen that it takes 7 time units to reach event C. The date of reaching event E from C is 7 + 5 = 12. In order to achieve an event, all preceding activities must be completed; therefore, since 12 is greater than 10, 12 will be the earliest date of event E. Proceeding to the end event G, the date of reaching event F by way of event C is 7 + 2 = 9; and event G is reached by way of event F in 9 + 3 = 12. The other path leading to G passes through event E, whose date is 12. The time taken to reach event G by event E is 12 + 4 = 16; this is longer than the path through F (12). The earliest date of event G is therefore 16 time units.

The longest time, which takes these 16 units, passes through events A, B, C, E and G.

The network is shown again in Figure 13, showing the earliest date (TE) alongside each event.

Figure 13



Latest date of events

The latest date (TL) of an event represents the extreme date at which this event can still be achieved without delaying the final completion of the project.

It is obtained by setting a date for the end event of the network and working back to the preceding events.

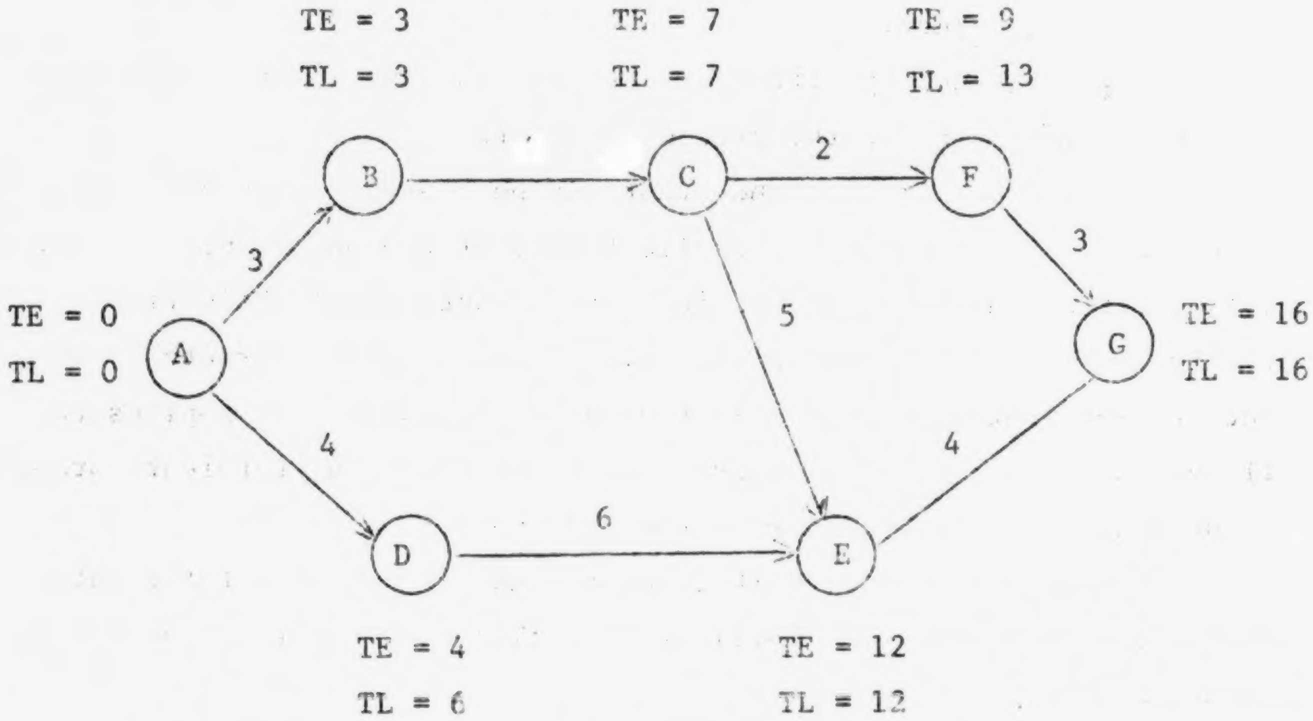
The date set for the end event may be chosen in various ways, first, it may be equal to the earliest date of the end event; it may also be set by the customer and indicate a contractual obligation, finally, it may be chosen arbitrarily by the Programme Director, who wants to see whether his plan is feasible. The same rule applies to all events which have no successor event and which may terminate branches of the network, independently at the end event.

We revert to the network taken as example and we set the date for the end event G at the earliest date (TE) or 16 units. The latest dates are calculated as follows.

Starting from event G to calculate the latest date of event F, the expected time of the activity, 3, is subtracted from the latest date, 16, of the succeeding event G. The latest date of event F which does not delay event G is therefore 13 time units. Continuing in the same way, the value of TL associated with event E is 16 - 4 = 12. Event C is reached by two different paths, C-F or C-E. The latest date for event C by way of event F is 11 units and by way of event E, 7 units; the date nearest to the start event, 7, is taken as the latest date of event C. This is the deadline for reaching event C without delaying the earliest date of the end event G. The TL values associated with events D and B are 6 and 3. There are two arrows starting from the start event A. The TL value calculated from event B is 0, and from event D is 2. For the same reasons the lowest value, 0, is taken as the latest date of event A.

The results of calculating the latest dates are shown on the network in Figure 14.

Figure 14



Slack and critical or sub-critical paths

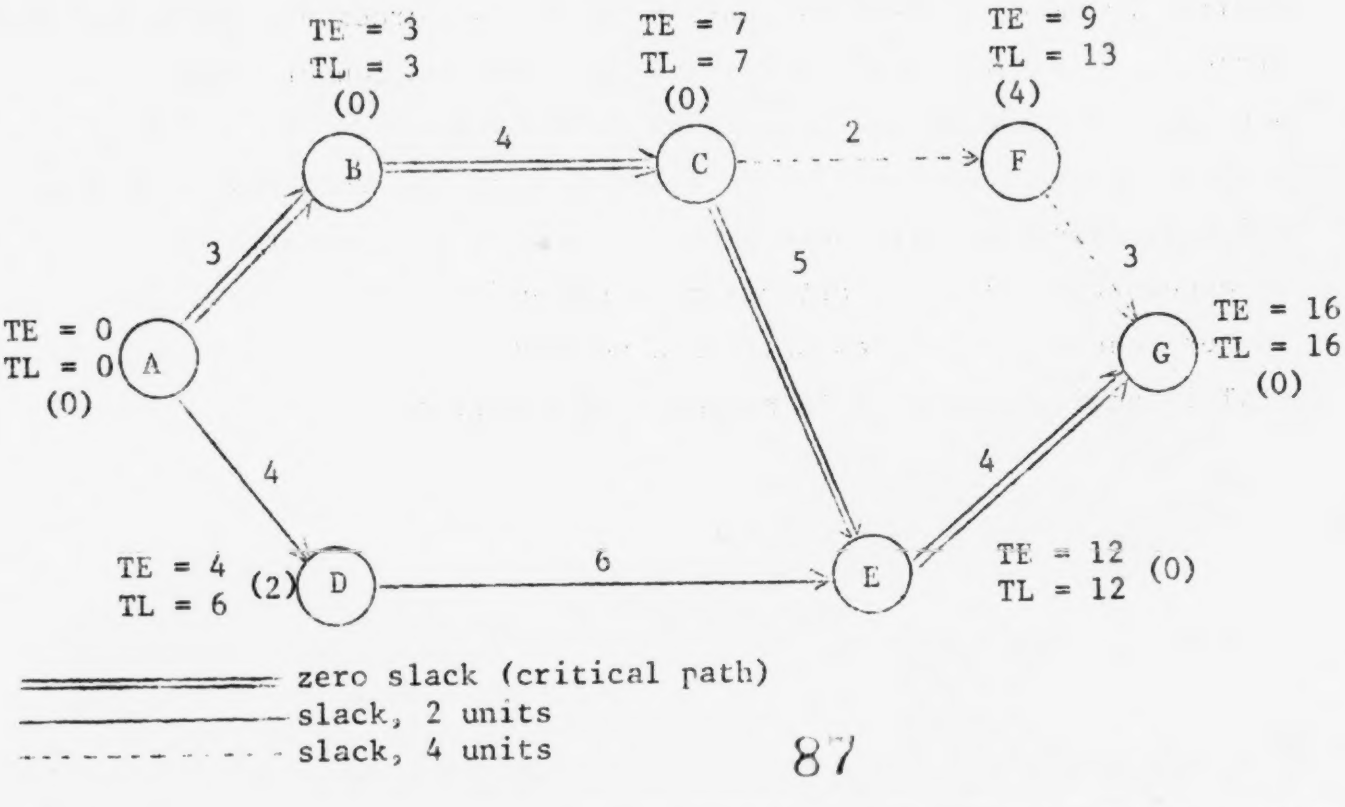
Where there is more than one path between its start event and its end event, a network nearly always shows slack. This (the difference between the earliest date and the latest date) is the measure of the flexibility of the scheduling.

The sequence of events with the least slack determines the critical path. (If the latest end date is the same as the earliest end date, the critical path is formed by the sequence of events with zero slack.) Any prolongation of the time of any activity whatsoever on this path entails an equal delay in the end event. For example, if an activity on the critical path should be completed by the thirty-second week after the start of the programme, but is not completed until the thirty-sixth week, the end date of the programme will be postponed by four weeks.

Events which are not on the critical path are called 'sub-critical' (or 'non-critical'). The activity arrows joining these events form 'sub-critical paths'. These paths constitute chains dispersed throughout the network; they may have different slacks.

The slack of events is shown in brackets on Figure 15 for the network taken as an example. The sub-critical paths are distinguished.

Figure 15


TE = 3
TL = 3
(0)
TE = 7
TL = 7
(0)
TE = 9
TL = 13
(4)
B
4
C
2
F
3
5
3
TE = 0
TL = 0
(0)
A
G
TE = 16
TL = 16
(0)
4
4
TE = 4
TL = 6
(2)
D
6
E
TE = 12
TL = 12
(0)
zero slack (critical path)
slack, 2 units
slack, 4 units

If the latest date of the end event (often a scheduled end date) was 20 time units, the critical path would have a slack of 4 units. It would follow the same path as the critical path (zero slack) in Figure 16. If the start date of the programmes were delayed by 4 time units, the plan could still be carried out, since the earliest date and the latest date of the end event would then be the same.

If, on the other hand, the date of the end event was set at 12 time units, the critical path would have a negative slack of - 4. The significance of a negative slack is that, if all the events on the critical path are achieved at their earliest dates the end event will only be achieved 4 time units after the set date.

The analysis of slack is the most important set of information obtained from the PERT system. It provides those responsible with a complete description of their problems, and an excellent measurement of the gravity of each of them.

We stress this role as an instrument of measurement, PERT is a thermometer which detects and measures both the advance and the delay shown or foreseeable in the execution. And project chiefs are well aware how difficult it is, in the ordinary case, to assess these factors.

This type of information is also extremely valuable when it is desired to make the best allocation of the resources available for the project. A substantial slack is often an indication of excessive resources allocated to the activities on the path.

Equally important is the freedom which the responsible person gains to disregard with safety the activities with a large slack and to concentrate his full attention on the critical activities (5 to 10 per cent of activities only on a network of more than 500 activities). PERT is an instrument of 'management by exception'.

PROBLEMS IN EDUCATIONAL MANAGEMENT

compiled by the Division of Educational
Planning and Administration, Unesco
(Consultant: L.H.S. Emerson, M.A.)

I. INTRODUCTION

Object of paper

The object of this paper is to sketch the main problems in the management of education, so as to provide members of the Seminar with material on which to test the usefulness of modern techniques of management control in improving efficiency.

Content of paper

In memorandum EP.I/6452 Unesco experts were asked, in respect of selected management areas, to supply an analytical description of the decision-making, implementation and control process in their countries of assignment, with particular attention to difficulties and obstacles. Replies were received from experts in: Afghanistan, Argentina, Burundi, Cameroon, Cameroon (West), Cylon, Dominican Republic, Ethiopia, Guatemala, Haute Volta, Ivory Coast, Madagascar, Mali, Morocco, Nepal, Niger, Somalia and West Irian.

This paper incorporates all the problems mentioned in the experts' replies. First, it outlines problems common to all or most areas of educational management and then examines specific ones in four main areas: school building, the school map, the employment and training of teachers and the development of curricula and of teaching and learning materials and aids.

II. GENERAL MANAGEMENT PROBLEMS

Summary

Problems affecting educational management in general may be summarized under the following heads:

Staffing

The main problems which arise in connexion with staffing are:

(a) staff changes - often very frequent - interrupt the continuity of management. If the Minister changes, policy also may change, as it may too if senior administrative staff or technical advisers are changed.

(b) staff are insufficient in numbers.

(c) staff are inadequately qualified (a related problem is the emigration of qualified staff, or their absorption into other occupations),

(d) staff are insufficiently productive owing to lack of competence, experience or effort, to inefficient working habits or to excess of work caused by other peoples' lack of efficiency. This last is very common. Senior officials often have to spend time on minor tasks which their subordinate administrative or secretarial staff do not perform correctly,

(e) staff are absent for long or short periods, officially or unofficially, and no adequate replacements are provided,

(f) appointments of staff are delayed.

Finance

The problems of managing the financing of education fall under five main heads:

(a) sources and justification;
(b) estimating costs and requirements,
(c) authorization and appropriation,
(d) control of expenditure,
(e) assessing the value received.

Problems related to the sources of financing and the justification of expenditures fall into three main groups:

(i) identification of potential sources and the possible extent of their contributions, i.e., how much may be expected from the central government, provincial governments, municipalities, communities, religious organizations, international bodies, bilateral aid, foundations, etc.

(ii) ascertaining the criteria of sources and preparing projects which meet both these and national educational needs (this goes beyond finance but it is when this is sought that the problems tend to emerge),

(iii) showing that the benefits expected from the projects justify expenditures of the magnitude of those proposed.

In estimating costs and requirements the main problems are:

(a) ascertaining realistic unit costs, which will neither be too low to provide what is desired, nor be needlessly high,

(b) ensuring that all necessary items have been included, and unnecessary ones excluded,

(c) reducing to a minimum the external exchange component.

In authorizing and appropriating expenditures the chief problems are:

(i) the Ministry of Education fails to budget for all the funds required,

(ii) the Ministry of Finance refuses or reduces amounts budgeted for by the Ministry of Education,

(iii) funds budgeted for and approved are not forthcoming,

(iv) funds are diverted to other purposes, e.g., funds for new school building may be diverted to reconstructing schools damaged in an earthquake or flood;

(v) sources fail to come up to expectations, e.g., external aid is cut off or reduced,

(vi) payment of an instalment due for one period may be delayed until full accounting is made of funds previously advanced.

In controlling expenditures the main problems encountered are:

(a) the activity for which funds were allocated has not been carried out. Such failure is not, of course, a financial matter and the causes must be sought elsewhere

(b) activities have been carried out and payments are due for which no specific allocation has been made;

(c) satisfactory certification that payments are due is lacking,

(d) receipts for payments made are not in satisfactory form.

Control of expenditures and assessment of value received are closely linked. A major problem is that the form in which the Ministry of Education keeps its accounts to satisfy the Ministry of Finance may not permit assessment of the educational activities carried out. For example, all salaries may be carried under staff grades, which may not reveal what staff costs are by level and type of education. Nor may expenditures on buildings, supplies, etc., be so analysed. This may mean that the director of a branch of education may be unaware of what his branch's expenditures are, what the corresponding cost benefit figures are and how rapidly his allocations are being used up.

Structure and responsibility

The commonest criticisms levied against systems of educational management - as of public administration in general - in developing countries is over-centralization. This term is, however, misleading, since the problem is not centralization of authority, but failure to prescribe responsibilities attaching to posts, high or low, and to issue clear directives as to their discharge. The result is that minor matters are not dealt with at their proper levels but flow to the centre and engulf senior officials and even the Minister.

A subsidiary problem is that, even when responsibilities are defined, the officials concerned may not exercise or may not be allowed to exercise them. An organization chart which shows a score or even a dozen officials directly responsible to the Minister evidences an administration likely to be inefficient because the Minister cannot direct, supervize or even know about the activities of so many officials. However, a system in which only half a dozen or fewer officials are responsible to the Minister may equally be inefficient if the latter bypasses those theoretically responsible and deals directly with their subordinate officials, thus extending his immediate span of command with consequent lessening of his grasp of any one area in it.

Information

Statistical and other information is an indispensable basis for planning, decision, implementation and evaluation. Problems are universally encountered in developing countries because of insufficient accurate information. The commonest reasons for this sutation are:

(a) the data needed have not been asked for;
(b) data asked for have not been prepared;
(c) data prepared have not been despatched;
(d) data despatched have gone astray;
(e) data received are incomplete;
(f) data received are inaccurate;
(g) data received have not been processed, owing, e.g., to lack or absence of staff or to lack of or breakdown of machines;
(h) data are wrongly processed;
(i) data processed are not interpreted;
(j) data are misinterpreted.

Communication

Poor communications often pose serious problems. Firstly, the physical nature and the level of economic development of many countries often means that communications - transport of persons and correspondence, and telegraph, telephone and radio facilities - are limited and inefficient. This situation will normally be outside the power of the Ministry of Education to remedy. The problem therefore is so to organize the management of the Ministry as to reduce to a minimum the inconvenience suffered - e.g., by issuing standing authorizations and directions for action.

A second problem is that the means which do exist are not properly exploited, a correct balance not being struck among e.g., personal interviews, letter and memo writing, and the use of the telegraph and telephone. A third problem is that use of these means is often inefficient, communications - whether spoken or written - being too verbose, too imprecise or, more rarely, too brief. A fourth problem is inefficiency in the mechanics of communication - such is in the typing and despatch of correspondence, or in the making of telephone calls - due in varying proportions to staff inefficiency and to inadequate provision or maintenance of equipment.

Three further problems are that communications go astray or are not promptly attended to, as a result of inefficiency in despatch, transmission, receipt or reaction, that incorrect information is transmitted, causing erroneous action to be taken, and that information sent is incomplete, resulting in delays while further enquiries are made.

Human relations

Management may be adversely affected by the lack of satisfactory human relations. The main problems here are, by force of example and otherwise, to:

(a) arouse the maximum interest in achieving common goals,

(b) reduce to a minimum personal antagonisms and misunderstandings, and their adverse effects on work.

Ways need to be found of establishing satisfactory working relations in three main areas:

(i) within the Ministry of Education, both vertically among those occupied at different levels in common tasks and horizontally among those occupied at the same levels with different but related tasks,

(ii) between staff of the Ministry of Education and the staffs of other government or official bodies,

(iii) between the staff of the Ministry of Education, and non-official bodies and the public at large.

Co-ordination

When authority is not centralized but is dispersed, lack of co-ordination among the responsible bodies is a common problem in educational management. The problems here are to establish co-ordination:

(a) among different bodies having similar responsibilities in the same field (this may involve restructuring of authority),

(b) among different authorities with different responsibilities in the same field but without formal provision for correlation of activities and without any one body being designated as the convenor of meetings or the initiator of activities - e.g., a school building programme may come within the responsibility of the Ministries of Education, Finance, Public Works and Planning,

(c) within the same body if this has different responsibilities and fails to correlate them, e.g., the school building division of the Ministry of Education may initiate a building programme without related action being taken by the teachers and finance divisions.

Consultation

Apart from the consultation needed to co-ordinate bodies with official responsibilities in areas related to educational management, there is need to ascertain the views and obtain the co-operation of numerous bodies, public and private, with relevant interests. The chief problem here is to establish and operate consultative machinery which will provide the government with the benefit of informed opinion and gain outside co-operation, without unduly restricting its own freedom of action.

Decision-making

Decisions affecting work have to be made at all levels from the highest to the lowest. The two chief problems are delay in taking decisions and unsound decisions. Delays may be due to:

(a) responsibility is not clearly fixed so no one takes a decision - or else different decisions are made by different people with some interest in the matter,
(b) lack of necessary data,
(c) lack of clear formulation of the issues,
(d) no one alternative appearing clearly preferable to the others;
(e) procrastination,
(f) incapacity.

Decisions may be unsound because:

(i) responsibility has not been clearly fixed and decisions are therefore taken by persons other than those who should have taken them, or mutually incompatible decisions or partial decisions are taken by more than one person,

(ii) all data needed were not available or not taken into account,

(iii) the issues were erroneously presented or were misunderstood,

(iv) decisions were insufficiently rational,

(v) decisions were affected by non-technical considerations.

Procedures

Management problems are often attributed to procedures said to be over-complex, over-rigid, outdated or not to ensure that all relevant factors are taken into account. The problem here is to ensure that, although procedures may be complex and slow, they are not slower or more complex than they need be. If they are, probably the basic problem lies in one of the other areas mentioned in this section.

For example, 'over-complex procedures' may mean that too many people are involved, with the resultant problems of defining responsibilities, co-ordinating independently responsible persons or bodies or structuring spans of command. 'Over-complex' may also mean that the matter goes backwards and forwards between the same people an excessive number of times, owing to problems in defining the structuring responsibilities or in taking decisions. The term may also mean the inclusion of too much - i.e., unnecessary - detail, which raises the problem of competence in handling data. The problems of over-rigidity and outdated forms are both likely to be due to lack of proper definition of responsibilities in accordance with the situations to be expected.

Equipment and maintenance

Management is commonly hampered by lack of office and other equipment, e.g., typewriters, photo-copiers, duplicating machines and transport - at times concurrently with some over-equipping (perhaps as a status symbol), e.g., electric typewriters when manual ones would serve as well or perhaps better if the electricity supply and operators are not reliable - which raises the problem of establishing rational equipment priorities.

Most common of all are difficulties caused by breakdown of equipment through misuse or lack of maintenance. This indicates lack of responsibility or of competence, or of both.

Unforeseen events

Unforeseen events may always occur and upset the best organized management. Usually the most serious of these is war, which may divert human and material resources and interrupt supplies. International politics may interrupt or reduce the external aid or technical assistance upon which, for example, a school expansion programme may depend. Natural disasters such as earthquakes or floods may cause diversion of resources to relief work. Internal political unrest or uncertainty may hinder the making of plans or the implementation of projects.

The basic management problem here is to develop a resilience and an ability to improvise and execute plans to meet circumstances which could not be foreseen, without depending on this to replace normal planning procedures in meeting situations which could and should be foreseen.

Planning

Lack of planning is in fact the main cause of many of the management problems experienced and remedying this raises the problems of eliminating the following main deficiencies:

(a) lack of basic data, raw or processed,

(b) data not interpreted or incorrectly interpreted,

(c) projections of needs and of proposed provision not made or not made for all relevant sectors - e.g., enrolment, buildings, teachers, budgets,

(d) projections made incorrectly,

(e) imagination not used in drafting plans, e.g., new solutions not sought or proposed,

(f) plans not considered or adopted by executive authorities,

(g) projects not identified or prepared,

(h) co-ordination of various interests not secured,

(i) implementation and control machinery not proposed or not established,

(j) evaluation procedures not proposed or not established.

Control

Management often becomes inefficient through inadequate control over the various activities carried on by the education authorities. Control is needed in three main areas:

(a) the management of schools - buildings, equipment, maintenance, enrolment, staffing and supplies,

(b) the content of education - curricula, methods, media, materials and aids;

(c) finance - budgeting, appropriations, receipts, expenditures and unit costs (control, as also evaluation, in this area has already been mentioned).

The basic problems are four:

(i) to obtain necessary data and exclude unnecessary data on the past and present position and trends in matters for which the Ministry is responsible,

(ii) to process the data in the most appropriate ways,

(iii) to interpret the data in such a way as to make clear the position and the decisions and action which will need to be taken,

(iv) to take such decisions and action.

Evaluation

In evaluation, the chief problems are to devise and apply suitable forms of evaluation to serve three main purposes:

(a) to ascertain what has been done and what still needs to be done to implement policies, plans and projects already adopted,

(b) to ascertain how far these, when implemented, achieve their objectives, and

(c) to ascertain how far these objectives prove and are likely to continue valid, and what new objectives, if any, should be set for future activities.

Selected management areas

The foregoing problems and some of their subsidiary ones are considered below in relation to four main areas of educational management: school building, the school map, teachers and curriculum development. School building is considered first, although many of its technical aspects fall outside the specialized fields of planning experts, because the administrative procedures - which mostly form part of experts' general knowledge - provide simple and practical examples of needs for defined orders of activities and for co-ordination of different specialities. To avoid repetition, details in the other three areas which closely correspond to problems mentioned under school building have often been omitted.

III. SCHOOL BUILDING

Sites

The commonest problems encountered in connexion with sites are:

(a) sites are not selected by the time they should be,

(b) sites are not acquired,

(c) unsuitable sites are selected or acquired,

(d) sites are selected or acquired for non-technical reasons,

(e) sites are changed after designs and specifications have been drawn up or contracts signed.

Services

In the provision of services - water, electricity, gas, telephone, drainage - the commonest problems are:

(a) services are not available, e.g., the site is too remote or the capacity of the supply is inadequate for the load proposed;

(b) services are available but to an uncertain or inadequate degree, e.g., well water supply;

(c) services are available but are not connected.

Professional services

The main problems encountered with respect to professional services - architects, engineers, quantity surveyors and draftsmen - are:

(a) such services are not available in the country;

(b) such services are not available in the Ministry of Education, the Ministry of Works, etc.;

(c) services are available but are already fully employed and cannot undertake fresh work;

(d) professionals in private practice are too few, are not sufficiently competent, are too fully employed or are not attracted by the terms of service to work on official projects;

(e) in the selection of persons to perform the services, professional competence is not made a sine qua non.

Building design

The main problems in the field of building design which hinder efficient management are:

(a) the designs are not drawn;

(b) standardized designs are used with insufficient attention to local conditions;

(c) curricula are not given to the architects before designs are drawn, so that the balance needed among various types of accommodation is unknown;

(d) enrolments by grade, subject and sex are not accurately projected before the designs are drawn, so that areas and quantities are wrongly calculated;

(e) there is inadequate consultation between architects and educators before designs are drawn so that insufficient account is taken of general and special requirements, methods, etc.;

(f) designs are unsuitable in respect of lighting and ventilation;

(g) the layout is unsuitable;

(h) the appearance of the building is inappropriate;

(i) the designs involve unnecessary expenditure.

Briefing of architects, etc.

Before designing buildings and writing up specifications, architects, engineers, etc., need to be briefed. Problems may occur if the briefing is not done or if it is deficient in areas such as:

- the purposes for which the premises are to be used and the amount of use to be made of them, e.g., curricula, enrolments and number of shifts;
- minimum space standards;
- other minimum standards;
- types, quantities and standards of built-in equipment and furniture;
- appearance standards;
- cost limits.

Specifications

With specifications the main problems are:

(a) specifications are not drawn up, are not drawn up in sufficient detail, or do not cover all relevant matters;

(b) excessive quantities of imported materials are specified;

(c) specifications do not accord with availability of materials;

(d) materials specified are not sufficiently durable;

(e) materials specified are not sufficiently aesthetic;

(f) specifications involve excessive cost.

Building permits

Problems may occur because:

- building permits have not been obtained;
- the permits obtained are inadequate to cover all the constructional activities proposed.

Tendering and contracting

Serious management problems may arise and the economy and efficiency of building operations may be adversely affected if:

(a) work is not put out to competitive tender.

(b) tendering is insufficiently confidential.

(c) the lowest bid is automatically accepted regardless of counterbalancing factors, such as the reliability of contractors,

(d) the most favourable terms, financial and other, are not obtained,

(e) the contractors' capacity to execute the work is not assessed, or is over-optimistically assessed or assumed.

(f) the contract does not cover all reasonably foreseeable eventualities or provide for the settlement of disputes,

(g) the contract does not specify penalties for, and guarantees against, failure on the part of the contractors to comply with their obligations.

Construction

During the actual coustruction work, progress may be delayed because:

(i) unforeseen site problems, e.g., striking springs, sand, rock or unstable ground, are not rapidly solved.

(ii) the wrong site is prepared,

(iii) the site is not properly prepared for building (including the installation of prefabricated units), or for bringing in services, or for making access roads,

(iv) the designs are not correctly followed.

(v) specifications are not correctly followed.

(vi) materials are not ordered.

(vii) materials are ordered but not delivered.

(viii) wrong materials are ordered or delivered.

(ix) sub-contractors or different tradesmen are insufficiently co-ordinated, e.g., plastering may be completed before electric wiring is installed.

(x) work is imperfectly done;

(xi) there is insufficient sense of urgency;

(xii) workers go on strike;

(xiii) contractors become insolvent.

Inspection

Apart from lack of foresight and planning, many of the problems mentioned above may result from problems in organizing efficient inspection - e.g.,

- inspection is not carried out while work is in progress so that deficiencies are not noted before they are covered up;
- inspection is superficial or inefficient;
- adequate progress reports are not made to those who should receive them, or are not received or are not properly attended to.

Furniture and equipment

Main administrative problems in connexion with furniture and equipment are:

(a) furniture and equipment are not ordered or are not ordered in time;

(b) wrong furniture and equipment are ordered;

(c) furniture and equipment are not delivered;

(d) the wrong furniture and equipment are delivered;

(e) excessive amounts of imported furniture and equipment are ordered;

(f) local furniture and equipment prove to be of inadequate standards;

(g) imported furniture and equipment are delayed in customs, or the customs authorities make unforeseen demands for duty;

(h) furniture and equipment are damaged in transit or during installation;

(i) built-in furniture and equipment are wrongly installed.

Costing, budgeting and payments

Common problems in the management of the financial aspects of school building are:

(i) cost limits are not established;
(ii) established cost limits are exceeded;
(iii) costs have been inaccurately calculated,
(iv) costs have been incompletely calculated - e.g., they omit such items as local differentials, architects' fees and costs of furniture and equipment,
(v) contingencies have been inadequately allowed for;
(vi) price rises have not been accurately foreseen,
(vii) negotiations have not been completed with financing sources,
(viii) the work has not been budgeted for or has been inadequately budgeted by the education authorities;
(ix) the budget requested is refused or reduced by the financial authorities,
(x) no certificate authorizing payment is made;
(xi) certificate authorizing payment goes astray;
(xii) payments are not made when due and authorized,
(xiii) payments are made without proper certification that work has been done.

Timetable

Serious problems in accommodating pupils and staff arise if buildings are not ready when expected. The basic problem in avoiding this situation is how to draw up a timetable for the planning, construction and handing over of a building which, without diminishing any desirable sense of urgency, will take adequate account of the time needed for the various processes and of the problems these are likely to involve.

IV. THE SCHOOL MAP

Summary of problems

The school map shows, in detail varying with its scale, four main types of information,

(i) the geographical distribution of schools of different levels and types with enrolment, capacity, use and suitability;

(ii) the catchment area of each school, with the dsitribution of the general school age population and of school pupils,

(iii) areas, with population distribution as above, for which education is not provided or is only partially provided,

(iv) travel routes, means and times between homes and schools.

The main problems in drawing the school map and in developing the provision of education with reference to it are:

(a) obtaining population data,

(b) obtaining physical data,

(c) obtaining transport data,

(d) mapping data,

(e) ascertaining the capacity of schools and the suitability and condition of premises;

(f) ascertaining the suitability of present school locations and sizes and fixing future ones, with catchment areas,

(g) comparing use factors and costs of alternative solutions.

Population data

In getting the population data needed the main problems are to ascertain, either from existing data or by special enquiries:

- the geographical distribution of the population;
- the age structure of the population, especially that part of it which is of school age,
- the likely future geographical and age distribution, due account being taken of such factors as the natural growth rate, urban and rural development and employment, and migration;

- the geographical location - actual and in respect of educational facilities - of each child of school age or approaching school age.

Physical and transport data

Since the main interest in physical data lies in the accessibility of schools from pupils' homes, the physical and transport data needed are closely linked. The main problems are to ascertain:

- movement routes between school age children's homes and actual or potential schools,
- means of movement in use on existing routes, e.g., on foot, by bicycle, transport animals, motor vehicles, etc., and the journey times involved;
- seasonal or other periodic problems in use of routes, e.g., floods;
- possible ways of shortening journey times, e.g., by bridge-building or providing motor transport,
- possible new routes.

Mapping data

In mapping data, the main problems are:

(a) getting basic maps from e.g., defence forces, land use authorities, malaria control, etc.,

(b) modifying basic maps to meet educational needs (lack of cartographers may here be a problem),

(c) reproducing basic maps,

(d) mapping the catchment area of each school, existing or potential (as new schools are established modifications will of course be needed in the catchment areas of those existing).

School capacity and condition

The main problems in determining the capacity of schools and the condition of their premises are to ascertain accurately:

(a) enrolment and attendance;

(b) the quantities and types of different kinds of accommodation - classrooms, laboratories, workshops, etc., - and their areas,

(c) the type of construction, i.e., materials used,

(d) layout,

(e) condition of maintenance;

(f) quantities, condition and suitability of furniture and equipment,

(g) adequacy of services,

(h) location, area and suitability of site - e.g., accessibility and traffic conditions,

(i) optimum space and other standards to be applied.

School location and catchment areas

The location of existing schools, their size and the geographic sources of their pupils are matters of fact which should be easily ascertainable. Determining the suitability of their location and size, however, is a process similar to the planning process required for the development of the school map by establishing new schools or enlarging existing ones. In this process it is likely that many of the general administrative problems mentioned in the first part of this paper will be encountered.

The main problem in this process is that of choosing locations and catchment areas which will:

(a) permit an acceptable number of pupils to attend daily, travelling on foot (thus reducing to a minimum lodging and transport costs),

(b) enable, for the maximum number of those who cannot travel daily on foot, transport to be provided with minimum public expenditure;

(c) enable public expenditure on the boarding and lodging of pupils and staff to be kept to a minimum,

(d) provide the best obtainable educational and cultural environment.

(e) facilitate the recruitment and retention of staff.

School size

The first of these requirements raises the problem of fixing an acceptable range for school size, so that schools are not so small that they cannot offer suitably diversified curricula or make economic use of staff, while they are not so large as to cause educational, administrative travel or traffic problems.

It may also raise the problem of structure - e.g., in a 4 + 4 + 4 system it may be more economic or practicable to achieve a high proportion of day pupils at the intermediate level by adding fifth and sixth grades to selected elementary schools rather than by increasing the numbers of boarders or commuters by accommodating all intermediate pupils in separate schools.

Pupils' transport

The second of the requirements above raises the problem of making optimum use of:

(a) various means of transport, e.g., bicycles, animals, private vehicles, public transport services, school buses and launches, etc.,

(b) various ways of paying for or subsidizing transport, e.g., loan or grant of bicycles, provision of railway or bus tickets, etc.

Boarding

The third requirement raises the problem of the optimum use of various forms of boarding and lodging, with related grants or charges. This involves choosing, on economic and other grounds, among such forms as:

(a) free or partly free boarding and lodging provided by the educational authorities,

(b) subsidies for boarding and lodging provided by charitable bodies,

(c) financial assistance to pupils who make their own arrangements for board and lodging.

Amenities

The fourth requirement above raises the problem of so locating schools in relation to population, industry, agriculture, commerce and communications, that maximum advantage is taken of environmental features which promote the education and culture desired, while adverse features are avoided as far as possible.

The final requirement raises two problems, namely:

(i) how to choose locations which will not only be the most suitable as regards enrolment and education but will also be liked by the staff,

(ii) when this last requirement cannot be fulfilled, how to provide suitable compensations and inducements to enable staff to be recruited and retained.

Use factors and costs

Although not the sole criterion, economy will be a major factor in determining the location of schools, their size, and the boarding and transport facilities to be provided. This raises the problems of ascertaining:

- the use factors for staff, teaching and residential buildings, furniture, equipment and transport, and
- related unit costs.

V. TEACHERS

Problem areas

The main problem areas specific to the recruitment, training and employment of teachers are:

Needs for posts

Identifying needs for teaching posts poses the following main problems:

(a) fixing teacher/pupil ratios,

(b) ascertaining current enrolment and attendance in the schools concerned,

(c) making projections of enrolment and attendance,

(d) ascertaining accommodation, furniture and equipment already existing or definitely to be provided,

(e) co-ordinating the establishment of posts with the recruiting and appointment of teachers, the corresponding pupil enrolments and the provision of the required buildings, furniture, equipment and teaching materials.

Fixing teacher/pupil ratios poses a double problem:

(i) to fix, for different levels and types of education, overall average ratios which are both educationally acceptable and practically and economically possible;

(ii) to fix acceptable ranges of ratios, from the minimum number of pupils to justify a post to the maximum tolerable before another post is added.

Figures for enrolment and attendance come from records kept by teachers and the main problem here is to know how far these are reliable: figures may sometimes be inflated to justify the staff employed or requested. Projections of future enrolment and attendance are mainly a matter of planning, due account being taken of the opening, expansion, reduction or closing of other schools which might affect the figures.

New teaching posts justified by enrolments and attendance will need teaching (and perhaps living) accommodation, furniture and equipment. Data are therefore needed on what already exists and the main problem here is double: (a) fixing standards, (b) getting information. In fixing space, lighting, ventilation, equipment and other standards, the problem - as with teacher/pupil ratios - is to combine what is educationally acceptable with what is practically and economically possible. As regards getting information, many school systems lack the qualified surveyors needed for thorough surveys of school premises and the main problem is to devise questionnaires which can be completed by non-specialists - usually teachers - and yet give the needed information.

Establishing posts

Establishing posts poses two main problems:

(a) establishing priorities, first among the competing claims for human and financial resources of the different levels and types of education and, second, among different schools of the same type and level;

(b) achieving the necessary co-ordination among the establishment of posts, the recruitment of teachers, the enrolment of pupils and the provision of premises, furniture, equipment and teaching and learning materials and aids.

Qualifications

Qualifications required for the various posts must usually be a compromise among the qualifications professionally desirable, those which applicants are likely to have and those which the budget can afford. A major problem here is that, with rising educational standards, qualifications previously considered satisfactory within a few years become outdated and are too low. There is then the difficulty in upgrading or replacing teachers whose qualifications do not reach the new levels.

Salaries and allowances

The main problems in fixing teachers' salaries and allowances are four:

(i) to achieve and maintain comparability with the remuneration which similar numbers of persons with similar qualifications can obtain in other occupations;

(ii) to maintain an appropriate balance between teachers' remunerations and per capita income;

(iii) to provide allowances which will motivate teachers to accept posts they may regard as less attractive;

(iv) to avoid dissatisfaction at the lessening of the differentials between teachers' salaries and per capita income as the economy and the education system develop.

Conditions of employment

Apart from salaries and allowances, four main problems in fixing conditions of teachers' employment are:

(a) security of tenure,

(b) whether teachers should be regular civil servants,

(c) how far teachers should be expected to participate in out-of-school activities, e.g., youth clubs and community development,

(d) should posting be only with the individual's consent.

As regards security of tenure, the problem in developing countries is, as mentioned in the paragraph above on qualifications, that many teachers may not be able to keep up with rising educational and professional standards. If, therefore, they have security of tenure, pupils may be handicapped.

In whether teachers should be regular civil servants, the main problem lies in leave regulations. Teachers normally expect to be free for most at least of the three months a year during which schools are usually closed, and this contrasts strongly with the usual civil service leave of about one month.

Where educated persons are few, the participation of teachers naturally tends to be sought in many developmental, educational and cultural activities. The problems then arise of how far they should be required or permitted so to participate, and what adjustments should be made in their teaching loads.

For various reasons, some posts are much sought after by teachers and others are shunned. If the employing authority has power to direct teachers to posts, the problem arises of how to distribute justly the desired and undesired posts. If the authority does not have this power, the problems of advertisement and incentives arise.

Recruitment

The main problem in recruitment is to match this to needs. Estimating the latter involves the problems of making accurate projections of:

(a) losses to the present teaching force by death, retirement, marriage, leave of absence and dismissal,

(b) increases or decreases in the force resulting from adjustment of teacher/pupil ratios,

(c) increases resulting from increased enrolment (also, though more rarely, decreases resulting from decreased enrolment).

Matching recruitment to needs involves the problems of:

(i) achieving a balance between selection criteria and salaries and other conditions of employment such that sufficient suitable applicants to become teachers come forward,

(ii) establishing a reserve pool of teachers, especially from among those who have retired or have left to raise families, from which unforeseen needs can be temporarily filled,

(iii) providing employment - e.g., by withdrawing some existing teachers from the schools for in-service courses - for any unforeseen surplus of graduates from the training colleges.

Training

Training of teachers needs to be both pre-service and in-service. With pre-service training the main problems are:

(a) to make the training realistic, so that it is a true preparation for teaching in the conditions likely to be encountered in the schools;

(b) to achieve in the courses the optimum balance among pedagogic theory, observation, teaching practice and general education,

(c) to make courses of the optimum length in view of professional and economic considerations;

(d) to ensure that a satisfactory number of those successfully trained become teachers.

In-service training poses two main problems.

(a) to relate the training meaningfully enough to the teachers' work and conditions to capture and retain their interest

(b) to provide sufficient incentives for teachers to consider it worth their while to forego part of their vacations, or to study in the evenings and at weekends, in order to improve their educational and professional qualifications.

Posting, transfer and promotion

Some problems which arise in the posting and transfer of teachers have already been considered above in the section on conditions of employment. In promotion there are two main problems:

(i) to ensure that all potential candidates are duly considered and

(ii) to ensure that promotion is made on the ground of primarily professional merit.

Disciplining and dismissal

It sometimes occurs that the educational system is less efficient than it might be because not all teachers show a due sense of responsibility and conscientiousness in carrying out their duties. In all but flagrant cases the main problem is lack of competent and objective professional assessment of their work. This raises the problem of providing a better system of inspection than is commonly found (which, if it existed, would probably lessen the incidence of irresponsibility).

Records

Common problems in connexion with teachers' records are that:

(a) records do not show just how many persons are employed, since the same teacher may work in two or more schools and be counted as a separate person in respect of each,

(b) records are incomplete or not up-to-date, and do not show accurately the qualifications, performance, etc., of each teacher,

(c) records do not enable the global data on teachers needed for administration and planning - e.g., age, qualifications, length of service, sex, etc., - to be extracted.

(d) records are not kept in forms which facilitate the rapid extraction of personal or group data.

Payment of salaries, etc.

A common problem, and one of great concern to teachers, is that salary payments are often very much in arrears, due either to maladministration at the centre or to poor communications, the existence of which has not been adequately taken into account or remedied.

VI. CURRICULUM DEVELOPMENT

Main problem areas

In curriculum development the main problem areas are:

(a) defining aims,

(b) identifying the main elements in curricula content and establishing their relative time allocations,

(c) preparing syllabi,

(d) developing teaching and learning materials and aids,

(e) reproducing and distributing such materials and aids,

(f) developing school broadcasts;

(g) re-training teachers,

(h) carrying out research and evaluation.

Defining aims

In defining aims the main problem is that many putative educational aims are out-dated, being based on religious, philosophical or social beliefs which no longer command their former wide acceptance. Establishing new aims, and re-formulating existing ones, raises problems of allocating responsibility and of providing and operating means for its exercise.

The problems may be grouped under four heads:

(a) determining who should be responsible for defining educational aims,

(b) establishing machinery by which such aims may be defined, with due representation of the various public and private sectors of society concerned;

(c) defining the aims;

(d) determining the respective roles of the schools and other educational institutions, of the family and of religious and other bodies in pursuing the aims;

Curricular content

In determining curricular content and time allocations the main problems lie in setting up and operating means of determining:

(i) the educational aims which each course is intended to achieve and, conversely, what courses are needed to achieve specified aims;

(ii) the duration of each course and the number of working hours or periods it will contain;

(iii) the subjects to be included;

(iv) the time allocated for each subject;

(v) elements in each subject which should promote attainment of the aims adopted;

(vi) the relative importance of such elements;

(vii) for each subject, the optimum allocation of time and material among direct teaching, heuristic work and practice;

(viii) for each subject, the optimum division of time and material between theory and practical work.

Syllabi

In preparing syllabi the main problems lie in setting up and operating means of:

(a) drafting syllabi which will best enable the subjects concerned to fulfil the purposes for which they were included in curricula;

(b) achieving adequate co-ordination between syllabi for different grades in the same subject;

(c) achieving such co-ordination between syllabi for the same grade in different subjects;

(d) testing draft syllabi.

(e) approving syllabi

(f) reviewing and modifying syllabi.

Teaching and learning materials, aids and media

In developing teaching and learning materials, aids and media, the main problem is to set up and operate satisfactory means - e.g., a National Education Centre - of providing the professional and other staff needed. The task involves:

- designing and selecting, within established cost limits, the materials and aids best suited to promoting the different levels and types of education provided to achieve the aims adopted, and
- developing the related use of media, especially mass media - radio, television, cinema and press.

The main subsidiary problems arising are:

(i) securing due co-ordination with those responsible for aims, curricula and syllabi,

(ii) obtaining the co-operation of teachers,

(iii) writing textbooks, teachers' manuals, etc., and preparing prototypes of audio-visual materials and aids;

(iv) securing adequate feedback from schools on the use of materials, aids and media,

(v) evaluating and comparing the educational results of the use of different materials, aids and media,

(vi) producing cost-benefit analyses and comparing these for different materials, aids and media,

(vii) devising or adapting designs to reduce costs of materials and aids.

Reproducing and distributing materials and aids

In reproducing and distributing teaching and learning materials and aids common problems are:

(a) the Ministry of Education lacks the industrial and commercial facilities required;

(b) co-operation with other official bodies possessing or responsible for the facilities needed is unsatisfactory;

(c) the private sector is not equipped to undertake the work satisfactorily;

(d) the Ministry of Education lacks the professional staff needed to draw designs, write up specifications, make cost estimates and inspect products;

(e) tendering, contracting, inspecting, approving and paying for work causes difficulties analogous to those considered in the section on school building;

(f) storage and transport facilities are inadequate;

(g) there is lack of qualified store-keepers.

School broadcasts

School radio programmes - and television ones when feasible - are a major solution to the problems of introducing new curricula into schools and of training teachers in their handling. Setting up a school broadcasting system, however, gives rise to numerous problems, which are not listed here.

Re-training teachers

New curricula, materials and aids, and the use of media such as broadcasting, require the re-training of teachers to handle them. Three main problems are here met with, of which the first is to provide re-training in the most efficient and economical ways. This involves the problems of ascertaining and comparing the costs, advantages and disadvantages of such solutions as:

(a) withdrawing teachers from service to attend courses (this raises the further problem of replacement);

(b) providing vacation courses;

(c) providing weekend courses;

(e) broadcasting training programmes for teachers.

The second main problem is to provide suitable incentives to persuade teachers to avail themselves of the opportunities for re-training provided and become competent in the use of new curricula, materials, aids and media. The third problem is what to do about teachers who do not respond satisfactorily to re-training.

Research and evaluation

Research is often conducted by bodies outside the direct authority of the Minister of Education. Two main problems are:

(a) to obtain competent research staff, and

(b) to persuade research bodies and staff to carry out research of direct relevance to national priority needs in education.

In evaluation, besides the problems mentioned in the section on general educational administration, a serious problem is the difficulty of devising objective forms of assessing ability and achievement in important aspects of education, such as the development of attitudes, the use of imagination, etc., so that these may be taken into account along with aspects of education, such as memory work, which are more easily assessed.

WORKING GROUP REPORTS ON PROBLEMS IN EDUCATIONAL MANAGEMENT

Report of Working Group on Curriculum Development

Chairman : Mr. A. El-Koussy
Rapporteur : Mr. K. Robinson

The working group on curriculum development at first covered the subject in free-ranging discussion and then concentrated on the first and last of the eight main problems listed on page 26 of the working paper (Problems in Educational Management), namely: defining aims or goals, and carrying out research and evaluation. In addition, however, the group noted several problem areas not mentioned in the working paper.

The problems reviewed may be summarized as follows:

(a) The need to visualize the future

It is clear that when a curriculum is revised it is intended for use up to 10 or 15 years ahead. Those engaged in curriculum revision often have no idea what conditions will be like after such a period. The Delphi method, together with orthodox forecasting, could be of much use in the writing of scenarios which would enable those who make decisions about curricula to visualize the future conditions for which their curricula are intended.

(b) The need to decide who will fix the goals of the new curriculum

At present this is often done by a small group of people in the Ministry of Education. There is little consultation. It was suggested that under such conditions a panel of people could be chosen for this task in the way that they would be chosen for a Delphi method panel, i.e., covering all relevant opinions, and including parents and children.

(c) The need to fix the goals of the new curriculum

The Delphi method would be useful in the preparation or review of proposals to be submitted for decision in fixing the goals. The method to be followed was further elaborated under the problem of giving effect to proposals described in (e) below.

(d) When the goals are fixed it is necessary to decide how to achieve them

The new goals may involve changes not only in the curriculum but in the structure of the entire education system. In planning how this may be done efficiently, PERT would be helpful.

(e) The next problem is to decide the means and methods of changing an existing system and then to carry it out

First it was stressed that some ministries and departments of education are ill-prepared for initiating such changes. Innovations are carried out with little consultation by over-worked officers. Some restructuring of the Ministry or Department of Education itself may first be necessary.

A need was felt for creating a mechanism or board capable of carrying out the following functions:

(i) preparing proposals on the basis of wide consultation and study;

(ii) exercising a review and evaluation function in relation to the implementation of decisions by the Ministry of Education and other bodies.

The essential feature would be the separation of the function of identification of objectives and indicators of their achievement, from the review and evaluation of operational [illegible] prepared by the Ministry and other bodies.

In so far as management overseeing would be required to give effect to the first of these two functions, review and evaluation would be a natural part of the activities of this board, not removing the need for the evaluation of individual operational programmes by the bodies responsible for their implementation. It was felt that

Unesco should prepare a detailed analysis of the steps involved in the evaluation and reform of a level or type of education so that countries may have a guide on how to proceed.

Emphasis was placed on the importance of flexibility. A curriculum suitable for a school in the north of a country may be unsuitable in the south. Changes may best be introduced school by school. Consultation is essential. The Delphi method, PERT and PPBS can all play a useful part, particularly in bringing about changes in a system which has become hidebound. PERT would be particularly useful in planning the various steps of the operation on a big scale, and also, on a smaller scale, in such operations as the production of new textbooks.

(f) After the curriculum has been changed it is necessary to test it to see if its stated goals are being achieved

It was pointed out that investment in education is now so great that public demand is building up for measuring results. The importance of programme-budget planning is likely to increase in proportion to these pressures.

(g) The revision of the curriculum must be a continuing process

As changes in conditions are likely to proceed at an ever faster tempo, a mechanism must be built into ministries of education to enable curriculum revision to proceed continuously. In this the Delphi method will again play an important part.

Running all through the discussions was the warning that mere techniques, no matter how new, cannot achieve miracles on their own, but they can be used to bring about new thinking in an outdated system, to produce sounder decisions and to get better results.

The last part of the time available was spent in brief study of the uses of the Delphi and PERT techniques as applied to some of the main operations relevant to curriculum development and its application. It was not possible to arrive at firm conclusions but rather to become aware of some of the difficulties and ambiguities involved. One operation, for example, might on analysis be found to consist of two aspects in which a given technique would not be useful in equal measure. Nevertheless the discussion ended with the elaboration of a draft table indicating to what extent the group felt that the uses of a technique were small or large for a given operation. This is shown below.

An assessment of the usefulness of the Delphi and PERT techniques in certain operations

Operation	Delphi	PERT
Selection of participants	M	S
Definition of aims	M	
Programming	M-S	M
Evaluation design	M	S
Teacher training and retraining	S	M
Implementation (distribution, etc.)	S	M

M = much usefulness

S = some usefulness

Report of Working Group on School Building

Chairman : Mr. J. Hartley
Rapporteur : Mr. B. Duvieusart

The group decided to study Document S24/4 (Problems in Educational Management) and to choose some exact aspects for which the utilization of modern techniques of administration would usefully replace the deficient procedures now used.

Among numerous suggestions, two projects were determined upon:

- the application of the Delphi method in order to establish suitable communications between architects and educators with regard to the design of school buildings (page 14).
- the application of PERT to the process of bid-tendering and contracting (page 15).

A first attempt in the application of the Delphi method involves the following situation: we are building today school buildings which will be in use for about 30 years while utilizing educational concepts which will be out-of-date in 5 to 10 years. Each participant was therefore asked to cite those educational changes which would appear in the coming years and which would probably influence school construction. Fourteen items were noted, each participant indicating the ranks of importance. Certain items which were given varying priorities by the participants were discussed and thus, after a second round, a list of six priority items were chosen.

In view of the limited time, the group decided to form two sub-groups, one continuing with the Delphi method, the other working on a PERT network.

The Delphi sub-group

The analysis of the Delphi exercise carried out by the group showed that the problem had been insufficiently defined in the early stage. With the help of Mr. Helmer, the sub-group attempted to work out a better procedure. This is summed up as follows:

First stage: collect a list of educational changes which will take place in the coming years.

Second stage: organize the list in order of importance.

Third stage: determine the architectural implications of each of the items on the first list.

Fourth stage: the architectural modifications will be listed in order of their importance, probably in a "double-entry" table: educational change - architectural arrangement.

Fifth stage: study of each of the architectural items so as to estimate the possibility of including them in a standard plan.

Sixth stage: for each architectural item establish a range of costs in accordance with the type of improvement made.

Seventh stage: within a given budget, choose the most desired improvements.

- For each of these steps, a list of consultants was established in accordance with the nature of the problem considered.

Sub-group PERT

A. Choice of an area of application: the process of bid-tendering and contracting.

B. Establishment of the list of activities:

(1) sending of a summary report from Education to Foreign Affairs.

(2) communication of the report to agencies, studies and responses.

(3) review of proposals and first selection.

(4) organization of the complete dossier.

(5) sending of the complete file as a call for bid to various companies.

(6) preparation and mailing of bids.

(7) technical and financial review of bids.

(8) educational review of bids.

(9) choice of company and letter

(10) draft of contract.

(11) final preparation of contract,

(12) authorization of expenditures,

(13) receipt of signatures

(14) sending of orders for service

(15) first phase of the work.

C. Construction of the network.

Study of the activities has shown that the sequence was almost entirely linear, the construction of the network, however, brought to light certain advantages of the method. Activities which were missing from the list became apparent and activities of the initial process were then organized in parallel form.

Conclusion

The two methods studied appeared very useful in the case of school construction.

Delphi has the advantage of sharpening the imagination and of usefully assembling the opinions of experts who would not be consulted in the traditional procedures.

PERT is a method which will surely become general in the procedures of school construction, and although the exercise was linear by chance, the application of the method showed certain advantages.

Report of Working Group on School Map

Chairman : Mr. M. Mathur
Rapporteurs : Mr. S. Romero-Lozano,
Mr. C. Olivera

The group recognized that school mapping in itself is a good management technique which can be used for more effective day-to-day educational administration as well as for providing guidelines for an educational plan for the future. It was noted that several of the new management techniques could be usefully applied to various phases of school mapping.

Concept

The school map is a means of presenting visually and geographically all data which is related to educational planning and control, and which can be usefully presented in map form.

It is not necessarily a single document, it can and probably should be rather an atlas than a single map.

It would be better to speak of 'school mapping' as a dynamic process, than to say simply 'school map', which is a static thing. The map itself has to be used as a tool for a planning process.

Objectives or goals

(1) To analyse the educational situation (of the whole country or of chosen regions) at the 'geographical' level as opposed to an over-all aggregate of data.

(2) To help plan the development of educational facilities on the basis of objective criteria.
- demographic situation and trends.
- economic and social development.
- suitability of school locations, sizes, types and conditions.
- transport and communication facilities.

(3) When national goals exist in a quantified form, to adjust methodically these objectives to the unequal situations of particular provinces or regions.

(4) To serve as a focal point for the gathering of a great amount of information usually dispersed among different services, thus becoming a very useful help for other planning and administrative units.

(5) To allow a better utilization of scarce resources according to very realistic estimates of costs and benefits in each particular zone.

Preconditions

There are a number of preconditions to be filled before a school mapping exercise can be started.

(1) a certain degree of administrative efficiency should exist, including a good flow of information and a set procedure for decision-making. In this context, careful consideration should be given to the four-sided relationships between the policy-makers and the technical people (at the national level), and the executives and the planning and mapping unit at the local level.

(2) a 'differential diagnostic' should have been established through the proper channels, according to an operational check-list (which is in itself a management technique),

(3) a general educational policy should have been defined, from which a set of criteria for the mapping could be set down.

The school mapping process

The actual process of school mapping involves the following main phases and operations:

(1) recruiting and eventually training the staff:
   - cartographers, coders, investigators, statisticians, cost analysts, etc.,

(2) establishing this team as a section of the Educational Planning Service (or of the National Planning Board),

(3) organizing the work of the team, and in particular the collection and collation of data (geographical and statistical);

(4) identifying the areas of operation,

(5) proceeding actually to collect and tabulate the data, both from existing documentation and from exploratory visits to the field. This will include estimating the information, when data do not exist at all, perhaps through the Delphi technique.
The indexing of all relevant data is the essential instrument not only for mapping but for over-all planning.

(6) determining the code to be used for the actual mapping,

(7) drawing the demographic and school map of the chosen areas;

(8) analysing the situation as shown in the map, mainly according to a study of costs and benefits,

(9) using the findings of this analysis, either for the preparation of an educational development plan for the area concerned, or for the possible modification of existing plans if this is shown to be desirable, considering in any case the feasibility in respect of resources and the efficiency of the use of such resources,

(10) using the map for proper implementation and control of the plan,

(11) projecting the map to the future to serve as a guideline for the development of a perspective plan,

(12) as in every other planning exercise, evaluating the achievements to make corrections to start new planning processes.

Application of new management techniques

(1) The Delphi technique: to establish priorities among objectives and also to provide some basic information where no data exist.

(2) PERT: to carry out the whole school mapping process.

(3) Theory of location, including programming techniques: to identify areas of operation and to determine location of schools.

(4) Operational research techniques: at different stages of the work.

(5) Cost-benefit analysis: to select one among competing alternatives in order to achieve a particular objective.

(6) Systems analysis and design technique: of particular relevance to the school-mapping process, since the map is both an information system and a dynamic tool for decision-making.

Concluding remarks

In real life logic does not operate fully: there is usually a gap between what the planner desires and what the top authorities finally decide, for reasons other than technical. The new management techniques in the area of school mapping (and in the wider field of educational planning and administration) should enable the planner to bridge this gulf to the maximum possible extent.

The group recommends to the Seminar to consider some concrete steps that may be taken to disseminate the new management techniques at national, regional and international levels in a fashion which would ensure the utmost multiplier effect. This would promote improved educational management and decision-making all along the line.

Report of Working Group on Teacher Training

Chairman : Mr. F. Riveiro
Rapporteur : Mr. H. Varlet

The group studied the over-all operations of recruitment, training, and assignment of a new type of teacher, considering the objectives of a general development plan for an educational system.

The study was made in the form of a PERT network, including at certain levels the utilization of the Delphi method.

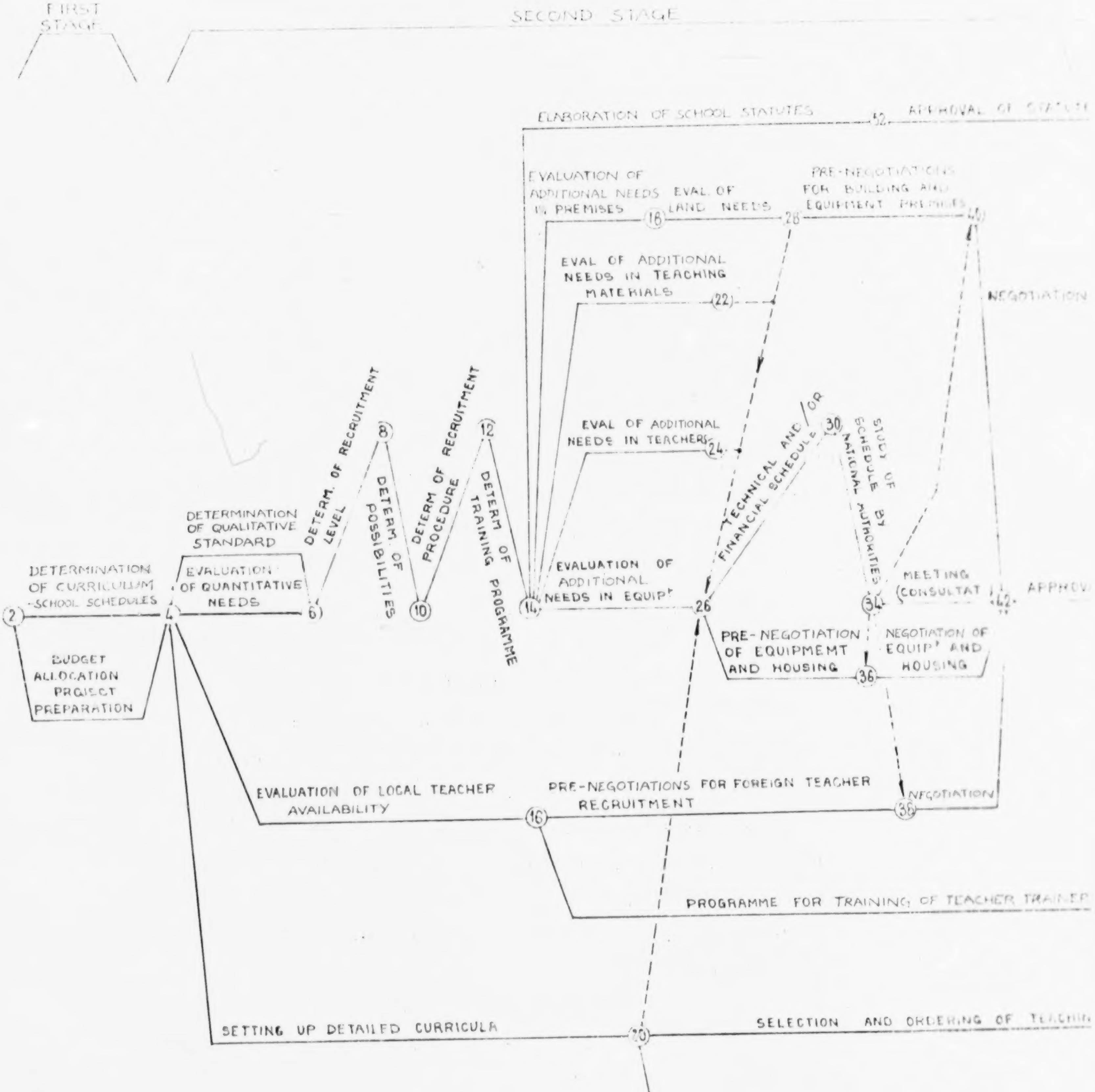
Beginning with the document IIEP/S24/4 (Problems in Educational Management), and taking into account the very short time available, the group limited itself to an exercise on the possible utilization of PERT in the case of a teacher training programme. It established a standard PERT macro-network which, considering certain necessary changes, might be applied in the study of different types of teacher training programmes. The time and the costs, which vary according to the countries and the different levels of training, were not evaluated. There could have been opportunity to consider the possible use of other techniques such as PPBS for example and for very complex programmes which would require a computer. This simplified PERT planning should also be useful in the study of training programmes for inspectors and administrators. It includes three central steps.

(a) preparatory plan,

(b) draft project based upon general curriculum and school schedules,

(c) execution of the first annual portion of the project.

The network includes about 50 operations not including the dummy operations.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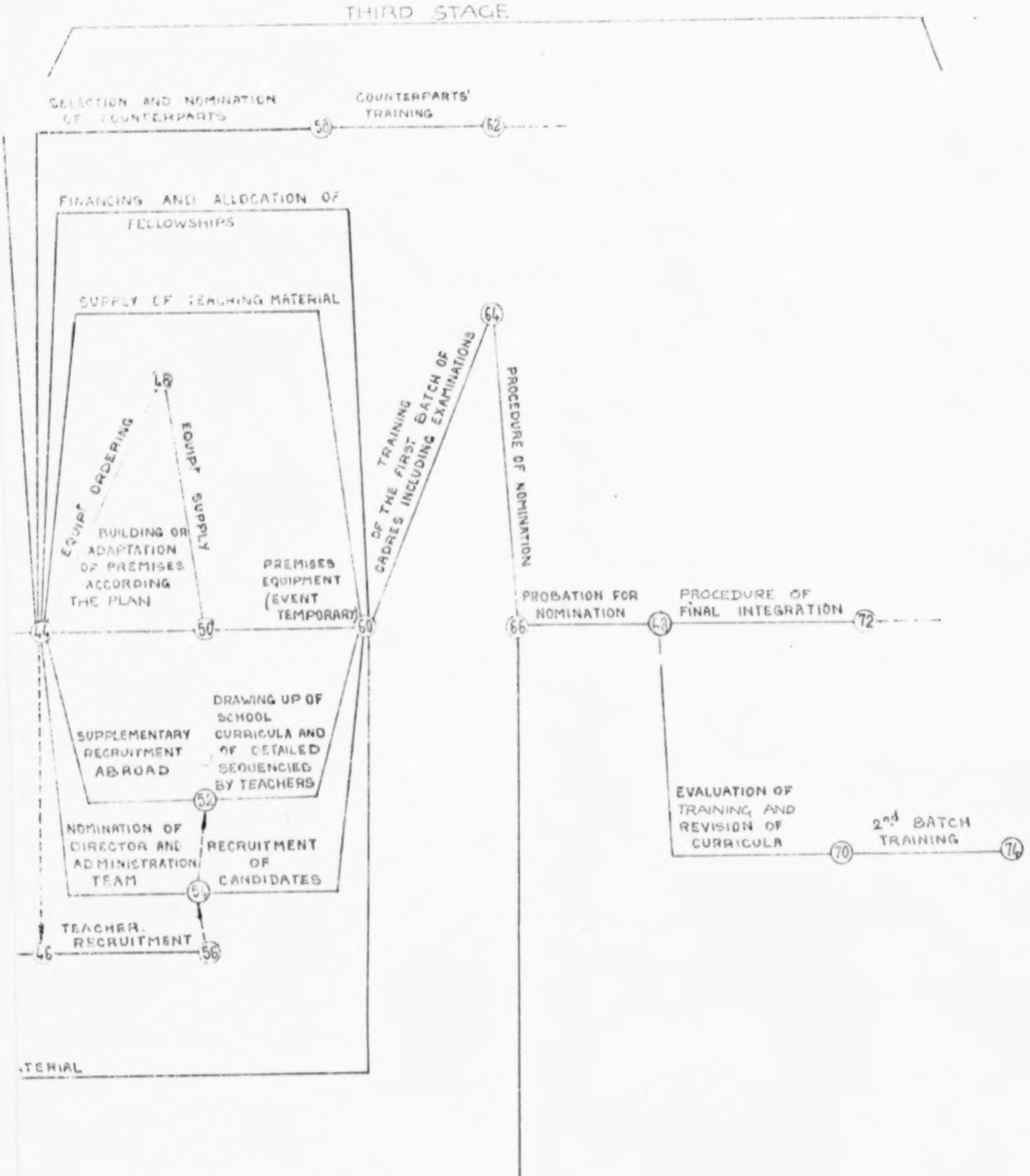
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PLANNING FOR EDUCATIONAL DEVELOPMENT IN A PPB SYSTEM

by Selma Mushkin

Prior research on education as an investment in people and as a tool of economic policy has provided a background for current efforts to deepen and make more specific planning for educational development (PED). Measurements of manpower requirements on the one hand, and of social demand for education on the other, have set the stage for additional questioning of the results from education, for more quantification, and for understanding of the usefulness of greater precision in planning. This paper is designed, essentially, as an aid in taking the step toward more detailed educational planning.

The paper is divided into five sections. The first deals with what is a planning, programming, budgeting (PPB) system. The second section relates to why planning for educational development within a PPB system. In the following three sections, each of the major components that comprise a PPB system is discussed. For example, section three deals with the structural aspects of planning for educational development, the defining of objectives, and the structuring of activities for the display of fund allocations among purposes. Section four presents a summary of the content of programme analysis and an illustration of an approach toward analysis. In the final section the purpose and processes of a multi-year programme and financial plan are presented.

I. What is a PPB system?

PPB systems have come to be defined in somewhat different ways as the basic concepts have been adapted by governments of varying sizes, complexities of responsibilities, and concerns of staff personnel and officialdom.

We define PPB here to mean a system of inquiry about, and management of, public programmes and activities by objectives. It is in essence a method of governmental programming, by objectives. The formulation and assessment of those objectives, examination of alternative programmes that can achieve them, measurement of resource requirements, and accountability for programme results are fundamental to the system.

We view PPB in the context of a system - a system for bringing together informative documents that as a routine process of management can provide policy officials with more and better information. The information that would be provided includes carefully examined purposes, programme costs, and potential programme results in achieving specified purposes through various programme options, both immediately and in the longer run. The routine of the system requires analytical documentation prior to official budget and programme recommendations. And as a system, PPB requires the orderly processing of analytical work so that the timing is appropriate for the cycle of work in budget preparation.

It is a system for: (i) helping to achieve government by objectives; (ii) formulating programmes in relation to operationally defined objectives; (iii) generating new programme designs and specifications; (iv) assembling total programme costs; and (v) analysing those programmes in accord with specified criteria for measurement.

Importantly, PPB is a system that provides an occasion for social invention and innovation. By requiring a search for options, the system opens the door to generation of options and consideration of various alternatives; at least it helps assure a more prompt and greater acceptance of assessment of new ideas.

It provides an occasion, too, for the consideration of interacting and inter-related activities that serve common purposes (both in the public and private spheres). That is, it sets the stage for inter-agency dialogue and communication in calling for a compilation of total costs and over-all programme effectiveness. For example, many government departments are concerned with educational achievement; education cannot be considered as an interest exclusive to the departments or ministries of education.

Elements of the PPB process generally are not new, but their combination and systematic application to education and other public affairs is. As indicated, earlier, these elements have come to be described in various ways, but we define them in terms of (i) structural aspects; (ii) analytical aspects; and (iii) the complementary feed-back, or accountability, aspects. In the work on these elements, a series of documents has been defined; these documents are the tools through which the PPB system is implemented. In addition to evaluation studies, they are:

(a) the programme structure and statement of objectives;
(b) programme analyses (cost-effectiveness analyses) and memoranda; and
(c) the multi-year programme and financial plan.

The components of the PPB system, the documentary tools, and the processes are outlined in Illustration 1.

Preparation of the several documents of a PPB system requires:

(i) clarifying and specifying the ultimate goals or objectives of each activity for which a government budgets money;
(ii) gathering contributing activities into comprehensive categories or programmes to achieve the specified objectives;
(iii) examining as a continuous process how well each activity or programme has done - its effectiveness - as a first step toward improving or even eliminating it;
(iv) analysing proposed improvements or new programme proposals to see how effective they may be in achieving programme goals;
(v) projecting the entire costs of each proposal not only for the first year but for several subsequent years;
(vi) formulating a plan, based in part on the analysis of programme cost and effectiveness, that leads to implementation through the budget.

Programme objectives

The statements of objectives of governments, and of education as a function of governments, are fundamental to programme structuring, programme analysis, longer range programme planning, and programme evaluation. Unless it is clear what outputs are being sought, there is essentially no way of knowing whether agencies are achieving them by the programmes adopted and expenditures made.

Illustration 1. Components, tools and processes of a PPB system

Component Elements	Documentary Tools	Processes Required
Structural	Statement of objectives	- Formulating and defining objectives - Formulating criteria of measurement
	Programme structure	- Classifying programmes and activities into a hierarchy - Assigning expenditures to classification of programme categories and elements
	Multi-year programme and financial plan	- Summarizing decisions taken in output and cost terms - Projecting programme levels ahead - Projecting workload costs of current programme ahead
Analytical	Programme analysis study (Problem definition statement)	- Defining objectives - Defining criteria of measurement - Formulating programme options
	(Cost-effectiveness studies)	- Developing model for analysis - Collecting data relevant to criteria of effectiveness - Collecting relevant cost data - Carrying out data analysis
Evaluative	Programme evaluation studies	- Collecting data on programme performance - Designing experiments where indicated

Formulation and definition of purposes require that cabinet officers and department heads ask anew about their goals in public service. What is it that is being sought by way of results or products? Or, what needs doing and for whom? Formulation also compels an inquiry into the following areas: Why is each activity currently performed being performed? For example, what are the purposes of 'human resources programmes'? Is the main objective to raise the level of output in the nation - to increase, that is, the nation's productivity and gross national product? Or, is the objective to improve the level of living and per capita income of the poorest in the nation? Or, is the primary purpose to develop the intellectual capacity of the nation for cultural pursuits? These purposes differ, and so necessarily would the criteria by which progress could be judged. The type of programme that is designed would also differ, depending upon the choice of purpose made. If all these purposes are sought, each still needs to be identified separately and progress toward each result measured independently. Those who must decide can judge in what combination they would emphasize national economic growth, correction of the worst pockets of poverty (whether or not the national output is raised in consequence), and national cultural development.

Programme structures

The programme structure itself displays a hierarchy of programme activities. At the topmost levels are the broad categories that reflect the programmes designed to achieve the fundamental objectives of the government. The second and lower levels display progressively narrower groupings serving more limited objectives. As the categories become narrower in scope at the lower levels, it is possible to classify within one sub-category complementary, and also substitute, programme approaches to the achievement of fundamental objectives. The lowest levels of any structure would be composed of activities and programmes that are intended as specific means for moving toward the larger objectives.

The display of programmes in relation to objectives provides information on programmes different in some ways from that contained in budget documents now submitted to legislatures. In many cases, budget documents are 'line' item budgets rather than programme-oriented budgets; full programme costs do not always appear in the same budget category.

Implementation of a PPB system does not require that the budget format be altered, but it does require that for programming purposes expenditures be grouped in terms of programme objectives rather than in terms of the items bought. In some jurisdictions budget formats have been altered.

A line item budget may show the following items with little regard to the purposes being served:

salary and wages;
contractural service, supplies, and materials;
equipment purchases by type;
sickness insurance;
invalidity insurance, etc.

Such a listing conveys little information about why employees are on the public payroll, why supplies are purchased, or what groups in the population benefit from the outlays. If, in addition to, or in place of, such line item information, a display shows the amounts expended in relation to objectives, the officials concerned with programme policies would have before them information on expenditures according to purposes. For example:

job training and placement:

- formal vocational training;
- on-the-job training;
- occupational counselling;
- employment exchange information

If, in addition to such figures on expenditures, data are presented on programme outputs that serve to display the volume or quality of the services provided, an additional range of supportive materials is given the decision maker. He would have before him the number of persons being trained for jobs, receiving formal school training, participating in on-the-job training or in joint school-industry training, being assisted in selecting training, receiving employment information, and those who on completion of their training are employed at specified earnings levels.

The classification hierarchy of categories, sub-categories, and so forth is necessarily a tentative grouping to be supplemented and altered as required by changing issues and problem emphasis. Basically the programme structure is an information document to be used by policy officials as an approximate guide or display of the choices that have been made among programmes and activities.

An array of expenditures in accord with a programme structure might tend to show, for example, how much of the nation's total budgeted funds is devoted to human resources. Within the human resources category it might show how much is devoted to health care and how much to intellectual development of the population. At a lower level the classification grouping might be designed to clarify for policy officials how the budget for education relates to the budget for job training and job placement; and from among the job training and placement programmes, the relative amounts for on-the-job training as contrasted with more formal technical training.

Evaluation feed-back

The system looks to the setting in process of a cycle of activities in which decisions implemented are subjected to in-depth review. The reviews are built into the process as evaluations of programmes and are designed to answer the question: Are the results obtained through the programme expenditures those that were sought? For example, in the United States, Head Start programmes were adopted as part of a battery of measures taken against poverty. These programmes were fashioned on earlier demonstrations of pre-school education as a method of helping to overcome cultural disadvantages in the home.

Evaluations suggested that any gains made through Head Start toward improving the poor child's capacity for learning were soon lost in subsequent elementary years. There was no significant learning difference among children in those follow-on years that could be attributed to the Head Start experience. This finding poses a policy problem analogous to any other public issue. It requires careful formulation as part of an analytical study. In the Unites States a new programme - Follow Through - was designed as a trial experimental effort to determine whether the combined special educational efforts - Head Start and Follow Through - would create significant gains in learning of the disadvantaged child.

The point to be emphasized here is that a feed-back loop on programme evaluation is an essential part of the process of problem definition and programme formulation. It is part of the questioning that characterizes analysis.

Programme analysis

Central to the PPB effort is analysis of programmes to assess the initial specification of objectives, to analyse the probable outputs in programme results in terms of the objectives as assessed from various programme options, and to measure total costs of the several options relevant to the programme decision.

Planning, programming, budgeting systems, as systems, are best applied on a government-wide basis in which defined objectives apply to the entire range of governmental activity. (Government-wide is being defined here to mean an independent taxing-spending decision unit.) The government-wide effort is an attempt to gain better understanding of the range of programmes and of departments concerned with the same or similar objectives. It attempts to provide a process within which departments or ministries of education, for example, may see the scope of current services under their direction that is important to satisfying the goals of other departments or of the government as a whole. Similarly, departments of education within this process may better comprehend the contribution that non-educational departments make to the mission of intellectual development of a population. When economic development is a central government purpose, the comprehensiveness of approaches to structuring the PPB system's work and analysis becomes critical.

Comprehensiveness in goal setting and structuring makes programme analysis the starting point of the PPB process for departments of education, especially in the developing nations.

The analysis process is a unifying and comparing one. On the one hand, consequences are assessed in terms of costs, both those that are immediate and those that are implicit for subsequent periods as a result of immediate action. On the other hand, they are assessed in terms of benefits or programme effectiveness. Showing costs and effectiveness side by side for various programme alternatives provides new information that can make rational decisions more likely.

Analysis essentially involves a reduction of complex problems into their component segments so that each segment can be studied. Questions of fact can be subjected through this process to the test of observed experience. Those aspects of the problem that involve value judgment can be separately identified and the basis of the judgment made explicit.

On the one hand, a cost-effectiveness analysis may use, if applicable, many of the techniques of mathematics, operations research, economics, etc. On the other, cost-effectiveness analysis may require no more technical sophistication than the pulling together of already existing data in a meaningful and informative way. Analyses may also draw upon various technical and non-technical studies previously done.

Recommendations made on the basis of analysis within the procedures of a PPB system are presented in policy papers termed 'programme memoranda'. The 'programme memo' is a document covering one major programme area or a major portion of a major programme area. Its purpose is to present major programme policy findings specific recommendations, and the reasons for these recommendations, including a summary of the analyses that have been made. It is submitted prior to detailed budget preparation.

In general, hundreds on hundreds of programme problems and issues would lend themselves to detailed analysis within each department of government, and many thousands for a nation. The number of problems far exceeds the analytical staff resources even in a nation as well endowed as the United States. In the developing countries, personnel limitations are severe. It is not possible, therefore, to analyse each issue in detail at the outset, or even over several years. It becomes necessary to choose a few issues for detailed analytical study. And for some issues so selected, the period of study required may postpone its immediate use for policy decision.

The multi-year programme and financial plan

Still an additional document of the PPB system is the programme and financial plan for a number of years ahead. This plan represents a step in advance fiscal planning. It is designed t show the future expenditure consequences in terms of costs and output changes of programme and expenditure decisions already taken. Or it may be designed to illustrate future expenditure plans. In effect, it represents estimates by objective of activity in physical units or outputs and as expenditure items. The expenditure estimates may reflect the growth in the period ahead attributable to price and competitive earnings changes, or changes attributable to varying rates of growth in population of various ages, or both the changes in physical workload units and changes in price per unit of decisions already taken. Or as indicated, the estimates may reflect in addition new programme initiatives intended in the period ahead.

Ideally, over the long run, as more extensive analytical work is carried out, a larger share of the documentation of the multi-year programme and financial plan will represent a summary of the decisions taken after examination of such analytical studies. At that time, a tentative summary of all initial individual programme decisions will provide the basis for an examination of the fiscal feasibility of the over-all decisions. For example, it is likely that the tentative set of individual programme decisions, when summarized in a multi-year financial plan format, will indicate a requirement for funds that is beyond either the current budget or those for subsequent years. Revisions of the programme decisions that make up the first tentative summary would then be needed.

Such a tentative summarizing does not necessarily imply that programmes should be planned only to the extent that their revenue sources are currently authorized. The governmental jurisdiction may choose to plan for a level of expenditure exceeding that which can be raised under current revenue provisions. But the question of revision of the revenue structure will be clearly posed.

The plan plays its second major function after the budget has been approved and a revised multi-year plan is prepared to reflect the latest decisions. The plan then becomes the 'base', or 'baseline', displaying the government's current multi-year plan. As such, it would provide planners at all levels with a perspective as to what the organization is doing and where it is headed. It also becomes the composite programme plan to which future programme proposals should be compared.

II. Why PED?

Planning for educational development is used here to mean planning for education within the context of a PPB system - that is, analyses of problems and issues on intellectual development of the population and evaluation of educational programmes and activities undertaken within an over-all government-wide system of objective setting and activity structuring.

The importance of PED to the developing nations arises both from external forces and from internal planning requirements. Education in the developing countries has been assigned a major and multi-purpose role - economic, social and political. In pursuit of those purposes, education in each nation has been assigned a large share of resources. The share reflects the priorities given, de facto, by nations to the development of the capacity of people to work, to advance from their current status to a more elevated one, and to participate in a democratic society.

Fiscal and other economic constraints facing nations are severe. Resources for education come at sizeable opportunity costs in terms of optional resource use. It is these constraints that suggest the necessity of careful and detailed planning for educational development.

In a sense, PED represents a natural sequence of progression in educational programming. It goes from the unplanned outreach to continuing demands for enlarging resource allocation for education, to the concern with planning for education as a facet of economic planning in which manpower and other human resource planning techniques come into wider and wider use, especially in developing nations. PED is an additional step in resource management that goes beyond the policy generalities of future manpower requirements and educational level needed to match those requirements, to the particulars of measurement of costs and effectiveness of alternative programme levels. And as importantly, PED looks to programme analysis and the feed-back of programme evaluation within a routine of processes from programme planning to budget making.

What are the external forces that contribute to this progression? Foreign assistance to the developing nations is increasingly being tied to the carrying out of analytical studies that consider educational aims and content for human resource development. Through several bodies - Unesco, the International Institute for Educational Planning, OECD - the donor nations have sought to encourage and support efforts to re-examine educational systems. They have urged the development of educational structures, curricula, teaching methods, and teaching certification to meet the special problems and conditions in particular developing countries. Objective evaluation of ongoing educational methods has been emphasized along with the analysis of new programmes and activities.

The World Bank in its lending practices has defined a range of activities for possible Bank projects that include:

(a) research and experimentation projects with new curricula and learning methods;

(b) assistance in long-range educational planning, curricula design, school management, and staff training;

(c) development and introduction of instructional television, school radio, programmed learning, correspondence education, and other technologies;

(d) development and production of teaching materials, including textbooks;

(e) establishment of education development centres;

(f) pilot programmes and schools in primary education;

(g) functional literacy programmes;

(h) construction and equipment of secondary and post-secondary institutions in general, industrial, agricultural, commercial, social, and paramedical education and training;

(i) construction and equipment of university faculties of science, engineering, agriculture, veterinary medicine, education, social science, and other clearly development-oriented subjects;

(j) technical assistance for the implementation of proposed projects.

Donor country activity and requirements continue to play an important role in the stimulus provided to planning activities. It is recognized that planning has to be expanded and made more precise to meet donor conditions, especially given the continuing reliance of developing nations on resources from abroad. Foreign training facilities, for one thing, have to be used by many developing nations. These nations, in co-operation with donor countries send their students abroad for technical and professional studies often not available in the recipient nations. And it may turn out also to continue to be more efficient for the developing nations to use nationals of countries abroad to fill manpower slots that require higher education, and particularly for post-graduate training. Such staff help may be provided as technical assistance for educational or other staffing purposes by donor nations. Moreover, as time elapses it has become increasingly clear to donor nations as well as recipient governments that subventions for physical investment have to be complemented by subventions or technical aid for human capital development. This means essentially a sharing of technical knowledge and technical capacity by the developed nations with the emerging countries.

We have underscored that increasingly foreign assistance will be conditioned on planning for educational development within a PPB system. More important for the installation of systematic procedures for implementation are the forces that compel more precise planning by the developing nations for their own purposes of better management of resources.

Curriculum, methods, and organization of many of the developing nations happen to have been inherited from one or another of the developed countries. Accordingly, it becomes even more important to view the education system in terms of the special purposes, needs, conditions, and resources available in each of the developing nations, and to tailor programmes and expenditures in light of the nation's own characteristics and goals by adoption of PED or some variant of in-depth educational analysis and evaluation.

Education as a part of over-all planning for economic development, social mobility, and political advancement has to be planned both in general format and in the specifics of what programmes, at what levels, for whom in the population, and with what timetable. On PED depends the planning for availability of manpower in the desired quality as well as quantity that complements and balances the investment in industrial capacity that is being made. Clearly, economic growth requires a balanced growth of saving and investment, of supply of educated manpower and employment opportunities generated by new investments. Without a careful synchronization of manpower development and industrialization, deficiencies in education would appear as bottlenecks to economic growth.

In its specified domestic purposes of specialized manpower skills, interest is clearly high about how to develop the skills most effectively, and at lowest possible cost. Among the various input options that need assessment are: alternative teaching methods, educational structure, curriculum, materials, plant, and relations with industry. The optional inputs can be combined in a variety of ways to develop specific manpower skills.

The scarce resources of developing nations, augmented as they may be by general grants or loans or educational provision of foreign exchange, foreign manpower skills, or foreign educational materials and supplies, compel more precise statement of objective and also inventive formulation of options whose relative costs and effectiveness would be measured.

Thus, the severe scarcity of resources, the urgency of domestic development purposes, and the range of possible actions to be taken point toward a beginning on analytical studies and programme evaluation within a general system. Without the umbrella of a system, analytical studies may serve no policy purpose and remain disassociated from ongoing public policy decision.

III. Learning: An investment or product of government structural aspects of PPB

We ask in this section that deals with the structural aspects: What are the key objectives that lead governments to undertake educational programmes? These programmes may take a variety of forms, including: (i) guarantees of educational services; (ii) production of educational services; (iii) financing of educational services. The government may act to assure that educational offerings are available, or may compel attendance through compulsory schooling requirements. The involvement of government may be larger in that the government itself may be the producing agent, either as a public monopoly or along with private educational agencies such as church schools or schools for foreign nationals. The government may finance these educational offerings out of general sources, or by the imposition of public charges or fees.

In the developing nations there are many patterns of governmental involvement in the education system, and this involvement may vary markedly for different levels of education.

Where there is governmental action on education, what are the purposes of the governments? This is a primary question that is involved in the setting forth of objectives as a basis for structure display of the educational plan for a budget year and for advance fiscal planning for education. It is a critical beginning to analysis of an educational question. The alternative of pursuit of a manpower policy that is dependent in some defined measure on educational services abroad also must be considered.

There is no one right way of defining objectives. We have suggested by the title to this section that we are assuming that learning is the central purpose of education and any schools provided or financed by the governments of the developing nations.

How does a range of services directed to gain learning fit into a pattern of governmental activities? There are many feasible patterns out of which the governmental undertakings may be outlined. One may take the broad pattern of development of man's potential within which to inquire about governmental activities.

The formulation of objectives and grouping of public programmes in accord with a selected theme, such as 'Development of Man's Potential', may be defined further by structuring programmes in terms of the age groups to which they are directed, as shown in the following example:

Theme: Development of Man's Potential

- (a) Developing children in their early years.
- (b) Developing children and youth:
  - (i) developing intellectual capacity;
  - (ii) maintaining and improving physical and emotional well-being;
  - (iii) maintaining and improving family environment;
  - (iv) maintaining and improving neighbourhood environment;
  - (v) correcting malbehaviour and protecting the public.

(c) Realizing the potential of working-age groups.

(d) Realizing the potential of the aged.

(e) General support and administration.

We have listed a few illustrative classes of programme objectives within the category, 'developing children and youth', the primary age group for whom formal education is carried out. For other age groups in the population, similar sub-categories are called for in elaborating the range of government programmes.

Another formulation of a central theme, and that which is likely to receive primary emphasis in the developing nations, is that of public investment for economic growth in which the range of public investment is set forth in accord with the various factors contributing to such growth, including human resources, physical capital resources, and natural resources. All government activities might be grouped as follows:

Theme: Public Investment for Economic Growth

(a) Investment in human resources:
  (i) health;
  (ii) learning.
(b) Economic growth - industrial supports.
(c) National resource conservation and development.
(d) Promotion of community development.
(e) Environmental improvements and safeguards.
(f) General administration and support.

In this grouping, learning is one of two major products that contribute to human resource investment as a source of economic growth; good health is the other.

Still another illustrative theme views governmental services as a series of consumer goods. Learning in this context is basically a consumer good which society purchases collectively or provides for collectively.

Theme: Fundamental Public Consumer Services

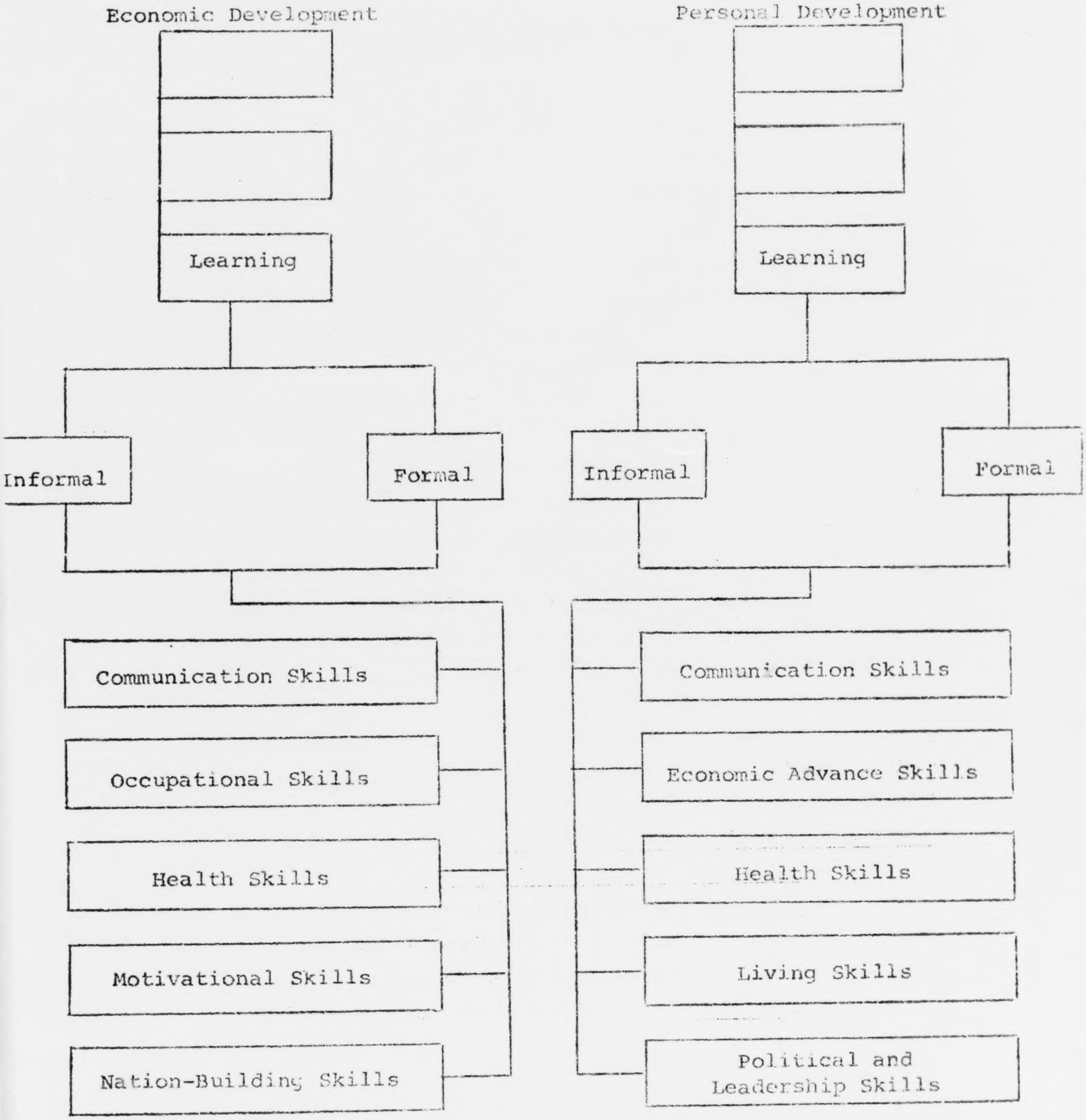
(a) Personal safety.
(b) Health.
(c) Learning.
(d) Satisfactory home and community environment.
(e) Economic satisfaction and employment opportunities.
(f) Satisfactory leisure-time opportunities.
(g) Transportation-communication-location.
(h) General administration and support.

For convenience of display, two routes to learning are distinguished - formal and informal. Informal learning takes place through two routes - the experience of living and working, and other informal channels such as public communication devices, family, and other personal relationships. Formal learning is designated as the product of a more formal schooling system, be it carried out by church or state, or under the auspices or financial support of one or the other.

In Illustration 2 learning through formal channels is shown in the context of the over-all purpose of (a) economic development or (b) personal development. The first two boxes are blank for both objectives; these blanks represent other categories of activities that contribute to economic development, for example, physical capital investment in infrastructure on the one hand, or to personal development, such as health care, on the other.

The chart shows the subdivisions of informal and formal learning methods and in each instance the major type of learning that may be sought: (a) the development of communication skills; (b) the development of occupational skills; (c) the development of health or hygiene skills; (d) the development of motivations for change; (e) the development of nation-building skills, including political and other related skills such as those of leadership and management.

Illustration 2: Categorical display of learning objectives


Economic Development
Learning
Informal
Formal
Communication Skills
Occupational Skills
Health Skills
Motivational Skills
Nation-Building Skills
Personal Development
Learning
Informal
Formal
Communication Skills
Economic Advance Skills
Health Skills
Living Skills
Political and Leadership Skills

Educational activities can be divided further in terms of the age groups in the population for whom the skills are sought; or the further classification can be in terms of urban and rural populations, or in terms of the particular ethnic groups in the population. (Illustration 3).

The special services required to promote learning of the five general types of skills listed would be identified within a programme structure and defined to include learning of the type necessary for the achievement of the over-all objective - economic development, or personal development. Such identification helps to flag the multiple layers of objectives that may be pursued - partly in the interests of efficiency and partly on equity grounds. Distinguishing the categories shown in Illustration 3 is not necessarily intended to suggest that separate programmes for each of the groups be carried out, but rather that it may be desirable to consider the special needs of the several groups in formulating programmes and activities. Further sub-classification may in fact turn out to be desirable to arrive at the necessary sub-groupings for careful programming. The adult population, including the young adults, might be divided between those who are literate and those who are illiterate. Or it may be desirable to divide the ability groups of children into those who are educable and those who are not.

To carry out somewhat the example of structuring services that have a learning objective, we follow through on Illustration 2 (presented earlier) and fill in a little more of the programme and activity detail. The outline is not intended to be comprehensive, but illustrative.

Objectives and definitions of educational services

(a) Development of communication skills

Objective: sequential development of individuals' capacity for understanding oral and written languages and for composing grammatically in those languages.

Definition: activities that sequentially develop skills in:

Illustration 3: Target groups identified

Learning of	Communication skills Occupation skills Health skills Motivational skills Nation-building skills
Basic economic groups	Rural persons Urban persons
Age groups	Children Youth Young adults Middle ages Aged
Ethnic groups	Africans Asians Europeans or by tribal groups
Ability groups	High Medium Low

- major language of nation: reading; spelling; grammar; composition;
- second major language;
- other languages used in trade and exchange or necessary for further occupational training.

(b) Development of occupational skills

Objective: enhancement of productivity, and preparation for specific employments that can advance national economy.

Definition: activities that can develop competence in occupational skills especially required for industrial development, and sequentially prepare individuals for higher professional and technical employment.

These activities include the basic educational skills, and activities that will permit an individual to qualify for sequential occupational advancement and higher education.

For example:

- computational and reasoning skills;
- technical education for each of the several occupational and industrial levels;
- on-the-job training;
- apprenticeships;
- college preparatory education

(c) Health skills

Objective: to develop the capacity of the individual to care for himself.

Definition: activities that will develop a knowledge of the physical self and lead to the achievement of health habits that will enhance the individual's ability to care for himself, including family planning. For example:

- nutrition education;
- first aid;
- personal hygiene instruction, including birth controls.

(d) Motivational skills

Objective: to gain a belief in improvement, a break in despair, and a perspective favourable for change from tradition.

Definition: activities that sequentially will motivate to change, including those that expose the individual to knowledge of achievements of other societies, of methods of change, including:

- history;
- political theory;
- economic development methods;
- community development activities.

(e) Nation-building skills

Objective: to develop a knowledge of the nation and appreciation of methods of participating in its development.

Definition: activities designed to develop the individual's understanding of the nation's development and his appreciation of the requisite of participation, leadership, and management for economic development.

Qualifications and difficulties

There are clearly a number of conceptual and practical difficulties in formulating a set of objectives for education or the development of learning in each of the several skills considered vital to the major purposes of the governments. Among these are: (a) the choice of objectives at appropriate levels to be operational; (b) the up-and-down process of objective setting; (c) the ranking and choices among single programmes and activities with several purposes; (d) the identification and selection of major purposes or categories for planning display purposes.

The level of abstraction

The appropriate level of abstraction is difficult to define. Educational objectives generally are stated by educational planners in a way far too broad or non-operational to permit easy translation of objectives into a framework for programme analysis or for a programme structure. These broad goals often, for example, view education in terms of its contribution to the economic life of the community, without specifying what is intended about that contribution. Similarly the purpose may be viewed as a contribution to the social order, to cultural patterns, again without defining what a contribution to the social order would be or what a cultural advance.

Often where beginnings have been made toward the carrying out of programme analyses or evaluations, objectives are not set in broad terms of the good life, or good citizenship, but in a way excessively detailed and specific. A recent Rand report notes:

> "Typically, a statement of an instructional objective identifies a specific terminal behaviour to be observed or measured, certain conditions under which the observation or measurement is to take place, and a standard of performance to be attained. The level of detail is such that a large number of objectives must be written to describe the results that are to be achieved by instruction in a single subject in a single year."[1]

To be useful for a programme structure display or for analysis, purposes must be defined operationally; that is, they need to be translated into defined measures of effectiveness or results, such as job skill achievements, reading test scores, indicators of family health planning, and so forth. Objectives of sub-programmes represent aggregations of the programme element level and should group the lower-level objectives in ways that are relevant to the questions that arise in making decisions about education.

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[1] S.A. Haggart, et al., "Program Budgeting for School District Planning: Concepts and Applications", Memorandum RM-6116-RC, Santa Monica, California: The Rand Corporation, November 1969.

Structure process and checks

The process of classification of activities into a programme structure can be carried out in two different ways. One way is to start with a formulation of purposes. These broad objectives can then be arranged into more operational sub-groupings or sub-classifications that then are more nearly associated with specific activities, as is at least partly done in the statement of objectives and their definitions. The second way is to ask about each of the ongoing activities: Why is this activity being performed? Then group such activities into sub-categories and categories so that a programme structure emerges that is descriptive of ongoing activities. Essentially, in order to avoid simply a justification of what exists without asking what needs doing and for whom, it is important that the process of asking for the formulation of a set of objectives about some ongoing activities needs to be followed. On the opposite end of the spectrum, however, in order to assure that all activities now carried out are in fact encompassed for purposes of programme display, it is necessary that those activities be reviewed and assessed in terms of why and with what result.

Multi-purpose activities

The formulation of objectives in terms of a programme structure is made difficult by the interaction of programmes and the varied response arising out of the same educational activity. It is very difficult to sort out programme interactions and to classify activities according to purpose without running head on into the problems of inter-programme reactions. Accordingly, it is necessary that there be cross-classified multi-dimensional approaches to programme structures in which activities can be flexibly regrouped as required for analytical study purposes. In terms of programme activity displays, such inter-activity dimensions can be built in through the process of displaying related activities and inserting the item into the programme displays without a corresponding expenditure amount to avoid double counting.

The educational activities designed, for example, to impart a knowledge of reading in a language may be conceived as an integral step toward the development of each of the five skills enumerated earlier. Or to take a less inclusive case, development of the occupational skills of mid-wifery or nusing would improve the individual's knowledge about his own physical self and his capacity for his own health care or personal hygiene.

Selection of single purposes for display

In terms of a practical step toward developing a programme structure to be used as a display and as a basis for the subsequent development of a multi-year programme and financial plan, choices have to be made about groupings of activities. These need not be rigid; on the contrary, only extensive experience with a programme structure will suggest whether it usefully serves policy purposes. For display purposes a decision has to be made on how a particular activity is to be classified within clear definition as to the content of that activity and the characteristics that distinguish it from others.

Earlier we suggested that it might be desirable to display programmes, whether in terms of the general objective of economic development or of personal development, by various target groups as well as by skills sought through learning to achieve the major purpose. Other groupings might turn out to be required for planning purposes. But for each purpose, the coverage of separate items has to be sufficiently distinct as to permit the assignment of expenditures to the selected activity.

Products of education may be grouped again in a variety of ways. For one thing, it is important to note that activities very often carried out by educational departments extend beyond the purpose of enhancement of learning, whereas there are a number of other activities carried on by non-educational departments that have important bearing on the carrying out of the purpose, learning.

Even within the concept of learning, as we have indicated, it is possible to group programmes in several ways. One way is by what is to be learned. Classification by types of skills to be acquired tends to be of this type. A second classification is according to learning by whom, in which the range of personal attributes are taken into account. This classification we have illustrated above in accord with target groups. Still a third method of classification is that of level or stage of education. Thus we now have identified three groups or categories: what, for whom or by whom, and level.

IV. Cost-effectiveness analyses

We have in section three discussed briefly the defining of objectives and the classification of educational activities in a hierarchical structure grouped into categories, sub-categories, and elements in accord with the components' relative importance and their breadth in terms of the objectives sought. In this section we turn to consideration of those objectives as part of an analysis of educational programmes. An analysis in these terms is designed to provide information for those making programme and funding decisions on the relative costs and effectiveness of optional ways of reaching the desired objectives. The process of analysis is a continuous questioning one: Why? What? Where? How? For whom? What else? At what costs? When? With what result? By such questioning the issue is clarified and defined, and specificity is given by quantification to the relative costs and relative effectiveness of various approaches to the problem as defined.

Analysis can help illuminate a range of problems that could run the gamut from detailed questions on educational methods or school plant location to the broad issue of relative investment in education or a steel factory, or the degrees of achievement of 'equality of educational opportunity'.

Analysis may shed light on the issue: Should more (or less) of the resources be devoted to primary or to secondary education levels? Should more (or less) of the resources be spent on adult literacy or child primary schooling? Should more (or less) of the resources be devoted to television instruction or more conventional classroom instruction? Should more (or less) resources be devoted to highly technical or professional training, for example, in medical specialties?

While analysis of programmes is central to the carrying out of a planning, programming, budgeting system, the evaluation and analysis of educational programmes may be undertaken with advantage whether or not such analysis is part of an integrated PPB system.

What is analysis?

Analysis, as defined more specifically in the paragraphs below, is a process of systematically (i) asking relevant questions about full cost implications and benefits of programme alternatives to satisfy objectives, and (ii) assembling information that bears on those questions. The questioning starts by defining programme purposes or objectives and by asking what alternative courses may be followed in reaching those objectives. It calls for inquiring about the uncertainty of estimates. It calls for documentation of the information brought together to give greater precision to the 'pros and cons' (gains and costs) of alternatives for meeting stated objectives, by quantified description where possible, and by qualitative statements where quantification is not possible.

The question and objectives

Specifically, analysis addresses itself first to: Are we asking the right question in terms of our objectives or purposes when we ask, for example, how do we attract teachers into the villages? Should we ask instead what educational opportunities should be provided for the villages? Such a reformulation broadens the question, places the emphasis on the recipients of the services rather than the providers, and opens the possibility for consideration of alternative means of providing the educational services.

By systematically attempting to identify the underlying purposes of education and the schools, a framework is set for the development and the documentation of relevant information that can aid in sharpening the issues for decision and in identifying the component considerations, including cost implications and likely consequences in satisfying the purposes sought.

Alternatives

Analysis calls for a search for alternative ways of meeting the defined objectives, a questioning: What are the options? What can be done in place of what we are now doing? A questioning process on options systematically carried out yields a range of possibilities for examination as to costs and gains.

Through the search for alternatives there is developed a built-in framework for social invention. A frequent criticism of government is that it is slow to accept new ideas. The educational community, among other groups carrying responsibility for public services, has frequently been charged with a lack of receptivity to new ideas. Adoption of analytical methods that routinely call for imaginative creation of new programmes and programme options should help to overcome this lethargy.

The product of analysis, with its emphasis on alternatives, would confront policy officials with a different kind of decision. In place of the familiar yes or no response to specific proposals, a range of choices would be provided, both in terms of activities and in ways of carrying them out. Thus, analysis may mean a more difficult decision, since it does not present merely a yes or no choice.

Documentation

Analysis means documentation, that is, a written statement on what is used as data, what is assumed, what logical sequence is followed in the reasoning. The sources and meaning of statistics that are drawn upon would be set forth. Major assumptions made to simplify the study would be detailed. The logical sequence followed in arriving at the formulation of the content of the study would be displayed. Limitations, uncertainties, and factors not considered would be clearly identified.

Such documentation permits others to review and understand what has been done. For those public officials who are especially concerned with any policy question or public issue, the documents provide a basis for careful examination of the detailed materials that underlie summary statements of choices for action.

Costs and gains

Analysis calls for two basic sets of information once objectives have been specified and the questions have been defined: (a) information on costs of programmes that represent alternative ways of meeting objectives, and (b) information on outputs or effectiveness relative to the objectives of various programme or activity options.

The information that needs to be brought together in costs and effectiveness occurs on three levels:

(i) cost and effectiveness in a given current programme for each level of the programme;

(ii) future cost and effectiveness implications of present programmes and alternatives for each level of the programme;

(iii) changes in cost and effectiveness that accompany changes in level of volume or quality of services provided, both current and future periods.

Programme costs in alternatives

Costing of public services and projecting costs for a future period are the more familiar components of the information that is brought together as part of an analysis.

For costing purposes, we need to know the total estimated cost of each programme alternative that is being considered, both initial cost and expenditures that are implicit for the future at the levels of services being examined.

As an example of 'costs' definition we draw on a case study prepared on education in Kenya by Hans Heinrich Thias and Martin Carnoy.[1] Costs are defined in that study both for individuals and for a society as a whole. Costs are defined to include earnings foregone as well as direct school expenditures. For individuals, direct school expenditures are represented by school fees. Since in Kenya higher secondary and university students do not pay fees, private costs for this level of schooling include only earnings foregone.

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[1] Hans Heinrich Thias and Martin Carnoy, "Cost-Benefit Analysis in Education: A Case Study on Kenya", International Bank for Reconstruction and Development, International Development Association, November 1969.

It may be useful to present, even if in capsule form, the methodology used in compiling the cost data for that study.

The putting together of cost data starts with a documentation of the school facilities in the nation. The financial data obtained relate to the multi-levels of government - municipal and general. In reporting the cost data for primary schools, the authors note: "The quality of data on finances depends upon the degree of competence of the local administrators". For primary schools, estimates had to be developed. These estimates started with data on numbers of teachers, their qualifications, and average salaries per teacher. (Average teachers' salaries were in turn derived from data on the distribution of teachers by salary scale in two of the counties of the state - counties that account for about 13 per cent of the elementary teachers in the counties.) To the estimated salary figures were added equipment costs. These non-salary estimates were based on information submitted by a few counties. In developing the estimates of direct costs, account was taken of economies of scale in primary education. Sample data from the ministry of local governments showed average teacher salaries per pupil, by size of school.

Capital costs also were estimated for primary schools, based on data compiled by J.B. Knight in the Unesco International Institute for Educational Planning report, The Costing and Financing of Educational Development in Tanzania, 1966.

In commenting on the method of cost estimating for the primary grades, the authors point out that the uniform cost per primary grade has a distorting effect. The higher primary grades, they suggest, require more qualified teachers at higher salaries. (Data quoted from a rural area study for Uganda, P. Foster and L. Yost, Population Growth and Rural Development in Bugand, College Park, Md., 1968, indicate a per pupil cost for the seventh grade more than twice that of the first grade.)

National coverage of secondary and university expenditures was found to be more complete than the data on primary schools. For example, for all government-assisted and maintained secondary schools, estimates of teaching and non-teaching expenditures were available by school. University operating costs were reported as part of the university plan.

For secondary education costs, separate calculations were made for each of the following categories:

- level of education, e.g., forms I-IV and senior secondary;
- schools with boarding facilities and those without such facilities;
- all classes of school costs, e.g., salaries;
- other costs.

Cost differences for the lower and upper levels of secondary education were noted to reflect differences in teacher qualification and in maximum legal class size.

Earnings foregone were estimated from sample survey data that permitted a profile of earnings to be constructed. Both work starting age and average delay in finding work for school-leavers were taken into account.

Approximate estimates are adequate for programme analyses. Margins of error are tolerable. The major consideration is whether in any array of alternative methods the figures are comparable from programme option to programme option.

Measuring effectiveness

Measurement of gains, benefits, or effectiveness that would be achieved by each of the alternate ways of satisfying the specified objective are far less familiar. Much of the discussion that follows is accordingly addressed to: How does one measure the effectiveness of an educational activity?

In private industry, product output is a relatively simple thing to determine. The output of a car manufacturer consists of the number of motor vehicles of various types produced - trucks, buses, passenger automobiles. For public goods and services, including education, indicators of progress or units of output have not received much attention heretofore. Recent efforts at evaluation of public programmes and services give a new significance to output measurement.

Professor Jesse Burkhead, in his studies on educational expenditures, has illustrated in summary form the production process of education in a manner somewhat analogous to that of industry. He shows the interplay of inputs and outputs as shown in Illustration 4. This illustration, as Professor Burkhead emphasizes, does not identify the whole range of possible variables in inputs, in process, and in outputs.

The measures we seek are those that can quantify how well we are meeting specified objectives. This quantification, in turn, requires new concepts of measurement. Though the aims of education may be hard to quantify, so are some of our other basic aims. In our democratic society we hold freedom dear, yet measurements of freedom have by and large not been developed. We have established institutions, our court system, for example, to assure our basic democratic rights, but we do not have measures of how effectively the courts and the governmental system as a whole are protecting those rights. The illustration of freedom is cited to suggest that the problems of defining measures of effectiveness for education, while difficult, are not unique.

What determines the yardstick used to assess whether satisfactory progress toward the achievement of objectives is being made? Several characteristics of such yardsticks need emphasis. The first of these clearly is the relevance of the measure to both the objective and the activity. The second is the completeness of the measurement; that is, the indicators of progress in combination should quantify all significant efforts of an activity. A further characteristic is to promote simplicity as long as the indexes encompass the major programme accomplishments. However, as we might expect, the availability of information and the potential for collecting new data will affect the indicators used.

Illustration 4. Input, process, and output variables in the educational process

Input variables	Process variables	Output variables
(land, labour, capital)	(current expenditure policies)	(benefits to the individual and society)
Student time in the classroom at home extra-curricular Personnel time administrative teaching clerical maintenance auxiliary Materials and supplies Buildings and equipment	Class size Size of the school Teacher/pupil ratio Ratio of administrative and clerical personnel to students Use of personnel for guidance for remedial instruction	Increased intellectual curiosity Social adaptation Development of creativity Increase in skills and earning ability Increased lifetime earnings. Growth of informed electorate Increased national growth

Source: Jesse Burkhead. "A New Way to View the Educational Process". Education in the States, Washington, D.C.: National Committee for Support of the Public Schools, 1966, p. 29.

Measurements of the effectiveness of various educational or related programme approaches to the objectives sought can be designed to capture as much of the range of outputs of education as feasible. They also can be restricted to a few proxy indexes that seek to capture and display only the major outputs, or can be restricted further to a monetary quantification of rates of investment returns.

Because of the importance given to economic development in the developing nations, the investment aspects of education's output tend to be given major emphasis. Thus the criteria that are given a primary place in various measurements are earnings differentials attributable to education converted to rates of return on the source inputs into education.

Again we draw on the study made by Thias and Carnoy on Kenya to illustrate the methodology of the analysis. The question addressed was: What is the return on investment in schooling? And: What are the relative rates of return on numbers of years of schooling at different levels? Additional lifetime earnings attributable to different levels of schooling is the base of benefits used in comparing costs to benefit gains.

The measure of effectiveness used is essentially earnings gains from additional years of schooling.

The estimating procedure carried out was designed first to determine income for each level of schooling group of African males with 11 or fewer years of schooling. A monthly income figure was used, adjusted to eliminate differences in earnings due to differences within the schooling group or between schooling groups in (a) parents' literacy, (b) father's occupation, or (c) other characteristics which influence earnings.

Similarly, a correction for rural areas was made for differences in income attributable to farm size (in acres) and to family size.

As a precondition to the carrying out of a benefit analysis of the type used for Kenya[1], it becomes necessary to gather data on age, education, and earnings for a cross-section of the population. Data on age, education, and earnings are not available in most places; thus the usefulness of the sample survey technique used by the Kenya study.

> "Our experience in Kenya implies that the necessary field work can be done in a very short time with a relatively small staff".

The Thias-Carnoy report notes the impediments to data collection that stand in the way of a rounded analysis of the returns to education at different levels. The problems include (a) the difficulties of allocating the value added in subsistence farming to the various factors of production, for example, the imputation of rent on land, and (b) the determination of an appropriate allocation of income among family members working the land in subsistence agriculture.

The Kenya study was based on two separate basic research reports, one for urban areas, the other for rural areas. A double stratified random sample of the country's firms, distinguishing among four size groups based on number of employees, and for three locations, provided the major source of the urban data. For each size group and location, a random sample of firms totalling 2.5 per cent of the country's 1967 employment in those sectors was taken. A total of 4,290 employees working in 57 firms were interviewed. In addition, a small non-random sample of public sector employees was carried out. These two samples provide the data on earnings and education for the urban area. Estimates of benefits form education were carried out separately for rural areas.

Rates of return were computed for several combinations or 'packages' of schooling: incomplete primary education (up to 4 years); completion of primary (5-7 years); incomplete secondary (8-9 years); completion of secondary (10-11 years); higher education (12-13 years); and university education (14-17 years).

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[1] Even if adjustments are not made for parents' literacy or occupation.

Care was taken to correct the estimates of earnings differentials for factors other than educational differences. The variables considered in making the correction were various socio-economic background data also collected in the course of the sample survey.

The analysis of alternative packages of 'length of schooling' on the basis of relative rates of return does not provide measurements of outputs from education other than earnings level differences. Nor does the yardstick 'earnings' necessarily provide adequate measurements for assessing differences in educational methods, such as changed technology for learning. Moreover, in some ways the criteria block out options for increasing gross product (aggregate and per capita) other than through formal education.

Very little has been done to develop effectiveness measures for the range of educational objectives relevant for use in the developing nations. As a trial, first-cut effort, there is summarized in Illustration 5 on the following page, criteria for evaluation of the several objectives enumerated in section three as sub-purposes within the more general objective of economic development. Education (formal or informal) is patently only one route to economic development. For the measurement of this development, it appears desirable to continue to use criteria such as rate of national product growth (total or per capita). But in addition, important policy guidance would be provided by developing tabular displays in matrix format, for example, that would for several feasible options show the outputs to be expected for each of the skill categories outlined in an earlier section. As an illustration of such a format we have enumerated several programme options; for each, the question that would be posed, in addition to cost, would be the outputs that are probable as measured by the types of output indicators shown in Illustration 5.

V. Multi-year programme and financial plan

There are various types of multi-year programme and financial plans. But each of these 'plans' simply documents or displays in a form readily available to those who are involved in policy decisions, Illustration 5. Economic development (product)

	Output Indicators
Development of communication skills	1. Numbers and proportion of working population with designated language skills for: (a) working with other nationals; (b) working with foreigners; (c) working outside of nation. 2. Number and proportion of annual increments of the workforce with designated language skills.
Development of occupational skills	1. Numbers and proportion of job vacancies in each occupational (or general industrial) category. 2. Numbers of new technically trained persons (a) entering labour market, (b) employed. 3. Numbers of new professionally trained persons (a) entering labour market, (b) employed.
Development of health skills	1. Numbers and proportion of workforce persons practicing designated health habits. 2. Numbers and proportion of workforce absent from work due to illness. 3. Numbers and proportion of women in child-bearing age groups practicing birth control methods.
Development of motivational skills	1. Numbers and proportion of adult (young persons) in rural areas that look with favour at changes in methods of (a) farming, (b) consuming, (c) living. 2. Numbers and proportion of adults (young persons) in rural (and urban) areas who are participating in designated programmes of motivational change.
Development of nation-building skills	1. Number of applicants for top-level public service positions. 2. Numbers and proportion of persons participating in elections.

and in the detail of the programme structure selected, the amounts of expenditures and the outputs expected for the immediate period ahead and for a subsequent period of years, such as three, four, or five. The output measures appropriate for a display are necessarily summary measures, simple, understandable, but as comprehensive as possible in capturing the essence of the outputs being produced in that part of the educational sector by the activities being undertaken. (The output measures that are being sought for the display purposes are akin to such economic quantity measures as kilowatt hours of electricity produced, or millions of board feet of lumber, thousands of hundredweights of rice, or rice acreage harvested, and such quality measures as grades of lumber or rice.)

Planning ahead for educational programmes has gained wider acceptance along with the application of manpower approaches to educational planning. The general concepts underlying the manpower approach essentially call for an estimation of the economic developments, and within the projected expectations with respect to economic change, the additional or altered manpower needs. In turn, the manpower requirements have been converted to educational requirements that are the counterpart of manpower needs. Taking note of the possibility of filling certain classes of manpower requirements through use of persons trained abroad and migration out of the country of trained manpower has, in some instances, been reflected in the figures derived.

Thus, training requirements and the procedures by which manpower needs are set have already involved many developing nations in projections. What are the differences between the multi-year programme and financial plan for education and the procedures that would be followed in any case through applying a manpower approach?[1]

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[1] Organization for Economic Co-operation and Development, Problems of Human Resources Planning in Latin America and in the Mediterranean Regional Project Countries, Report on the Seminar held at Lima in March 1965 and complementary documents, Paris, 1967.

(a) A manpower approach to educational planning, while it requires considerable projection work, does not derive the formulation of requirements from an analysis of the relative costs and effectiveness of alternative ways of supplying the economy's needs.

(b) The manpower approach does not ask whether it would be desirable to alter the physical capital/human capital mixes in terms of relative rates of return to the economy and its growth.

(c) The manpower approach to planning has not been tied to actual resource allocation decisions such as those that are involved in the budget determination. Programme analysis, in comparison, within a PPB system would be immediately related to the information base on which decisions are taken.

(d) Within the manpower approach there is no mechanism for analysis of various methods of producing education at the different levels and assessment of the relative costs.

(e) Further, the manpower approach does not call routinely for the feed-back of accountability of programme expenditures for the results achieved. The analytical approach within the planning-programming-budgeting system would in fact require such feed-back.

We have not, in discussing the differences between the manpower approach and the multi-year programme and financial plan, taken account of the differences in multi-year projection work that have evolved in the process of implementing a PPB system. Briefly, these various approaches are discussed here. First, in concept at least, it is possible to think of a multi-year programme and financial plan as the setting forth in summary form of the decisions taken on the basis of a wide range of analytical studies carried out. We have already suggested that the issues on which these analyses can be carried out are numerous, and it is unlikely that for some time to come the in-depth analyses could be carried out over the broad spectrum of the public services involved. Nevertheless, even without such detailed analytical study findings, the multi-year programme and financial plan document can be a useful document for decision-makers. As a forward-looking document it would spell out funding and estimated output for a period ahead by showing multi-year programme and financial consequences. Various models of economic development could be used and alternative projections of educational expenditures could be developed consistent with the aggregative economic models. It is feasible to inquire, for example, what the educational outlays would amount to in monetary terms if price levels and productivity changes in non-educational sectors increased by, for example, 3 per cent, 4 per cent per annum, or even to higher levels. It is possible to inquire about the effect of urbanization under alternative patterns within the over-all economic models on the possible demand for and expenditures that would be made in response to this demand for education. Such projections serve important policy purposes, although programme options have not been explored.

An analysis of employment changes as a function of average real wages and output in each sector also provides a way for developing manpower projections which can be used in an approximate way as a base for a multi-year programme and financial plan. This type of manpower projection approach to the development of a tentative multi-year programme and financial plan would provide added guidance for future planning.

An optional procedure in developing a multi-year programme and financial plan for policy use is a simpler but less related to future programme undertakings. Such a multi-year plan would display, for the years immediately ahead, costs undertaken as a result of policy decisions already made. Essentially this approach calls for the estimation of the residual or unfinished undertakings - for example, school plant construction, or university student opportunity expansion - that have been decided in the past. Programme decisions already taken would be displayed or would simply be re-costed in terms of changes of prices and wages. Such re-costing is essential if educational inputs are not to be permitted to erode silently in quality with any price inflation in the non-educational sector.

Planning within the context of a PPB system essentially is a continuous cycle of analysis and the feed-back of evaluation of programme results. It is a dynamic process that calls for review and revision of programme as appropriate for the budget cycle. And as such it contrasts sharply with the five-year plan approach to decision and action. The relation of more traditional planning to an integrated PPB system almost everywhere will have to be established both conceptually and administratively.

Discussion and extension of remarks

To me PPBS is a way of government life. It is a way of linking programme decisions to the hard facts of the budget and it is a way of planning programmes so that they are immediately implemented.

Now, what are the pruposes of planning-programming-budgeting systems? I think they are four-fold. The first purpose of a planning-programming-budgeting system is to identify the work of the governments in terms of the products produced. It is not easy to view government in the same way as one would view a shoe manufacturer, or a textile manufacturer, but in fact government does produce products of given quantity and quality and at a cost in resource use. And the task for which my colleagues and I have now spent some time and can be expected to spend some considerable time in the future, is to identify those products in terms of quantity and quality.

A second purpose of planning-programming-budgeting systems is to facilitate the making of choices in government. We all make choices in our daily lives between expenditures for food and expenditures for clothing, between expenditures for clothing and expenditures for housing, or we decide whether we are going to spend money for the theatre or to buy some books. Governments make choices, they have been doing it for quite a while. All that a PPB system does is to make these choices explicit.

A third purpose is to build a process by which programmes clearly are co-ordinated. Let me define that in a different way. To build a process by which governments package the products they produce so that they serve a larger purpose, either in terms of some target groups in the population, or some over-riding objective. For example, education is viewed as a means toward industrialization and economic development. There are a series of services that have the same over-riding purpose. Co-ordination is required to package these in some 'balanced way'. We do not quite understand how to make a package of public services, but this is a task we all have nevertheless.

A fourth purpose of a planning-programming-budgeting system, in my view, is to build a basis for innovation and social invention. A planning-programming-budgeting system routinely calls for the development of alternatives. The routine requirement for the formulation of alternatives at least assures that new ideas will have a ready place for investigation for analysis.

Now, along with these purposes there is the very large result that services provided by the government come to be measured in terms of results, consequences and in terms of the results for designated groups in the population.

Now if I may briefly take another look or another cut at this same problem, by asking what are the concepts that underlie a planning-programming-budgeting system? There are two simple micro-economic concepts and then two supplementary ones. The first concept is of trade-offs. Each action has an opportunity cost and PPBS makes this explicit. The second economic concept is that of marginal returns. Generally, programme planners tend to view increments of expenditures as if they produce proportionate returns. This is not so. We do not really know what the cost effectiveness line looks like for all of our governmental services. We are sure, however, that in certain cases you can spend much additional by way of resources and get very little additional return.

Now those are the two major economic micro-economic concepts that underlie the planning-programming-budgeting system.

We do not care about sunk costs so that anything spent backwards does not matter. What only matters is the consequences for the resource cut, the cut into the resource pie now and into the future.

Now that brings us to the fourth concept which is really tied closer to what we all have come to know as advanced fiscal budgeting, or fiscal planning, or anyway a set of tools with which we look ahead at the full cost implications and the full benefit implications on comparable basis at least with respect to cost for a period ahead.

These are the basic concepts of a planning-programming-budgeting system.

Now what do these concepts mean with respect to the orthodoxy of planning? Planning has usually proceeded on the basis that the more the better, the more the better of health, the more the better of education, the more the better of housing, the more the better of industrial growth. But not all these things can be achieved, and the planning-programming-budgeting trade-offs enforce a viewing of planning in the context of what you have to give up for what you want, viewing the range of opportunity costs that are involved in any set of choices.

The second change from the orthodoxy of planning is the one I mentioned earlier, namely it is not true that additional expenditures yield proportionate increments in products, in results, in consequences, so that you have to really know what the shape of these curves are before you make a planning judgment.

A third difference between the orthodoxy of planning as we have practised it heretofore, and planning in a PPBS context, is that we take account of the full range of costs whether or not they are incurred by a particular ministry, that is, which has the primary responsibility for the programme mission, purpose, or objective.

So we see that planning in a PPBS context is really quite different from the planning that we know in a 'Le Plan' context. I have gathered that there was a considerable interest in mass techniques, so let me try to outline the steps involved in implementation or the beginning of implementation of a planning-programming-budgeting system.

As nations have come to implement PPBS, with whatever title they choose to give it, they have adapted the system clearly to what is feasible, what is appropriate, what is desirable in their own national context. This is true not only of nations but also of municipalities. As a consequence, the common language we once used to have has disappeared, but if one is to begin implementation of a planning-programming-budgeting system there is only one way, and that is to begin. One begins essentially by a decision at some top level, either political or within the bureaucracy, that this is a desirable way of living in government. That decision having been taken, the next problem is one of staffing. We would judge that there has to be some critical mass of staff to make a difference and in some of the governments with which I have worked, that meant three people. But the staffang talents, staffing confidence, staffing qualifications are essentially of two kinds: there are the generalists, the generalists who know government, who know its history, who know how the particular governmdnt works and especially an official who has the confidence of other governmental staff. And then there is what I call the tool specialist, the mathematician, the econometrician, the statistician, the man who knows, or men who know, how to qualify and bring to bear whatever tools we have for qualification, or at least know where to pull the strings to get the necessary feed-in of skills for tool use.

Now, in most governments, there is a shortage of personnel that understand about analytical techniques, and accordingly a very large beginning has to be made by staff training. Training of staff means you have to start basically by training trainers, and developing materials for training. There is considerable body of material now that did not use to exist and the nations are beginning to produce analytical papers and studies that could be used for training purposes.

What about directives on beginning? My own view is directives should be underplayed rather than become the primary step, because it is more important to begin to analyse public services than it is to spend considerable time on the wording of a directive - a set of instructions. But again this is, of necessity, fitted into a pattern that fits the nation.

What about organization? I am talking to a group of educationists, but I must say that the central organization for a planning-programming-budgeting system necessarily has to be at some central place in the government and that is not the Department of Education or Ministry of Education. It usually is the Ministry of Finance.

Now many governments have elected to decentralize this system, to make it operate from departments. My own nation did that we worked it through department by department. I have some problems with this approach because I think governmental services are very closely interrelated and to have to be packaged and accordingly separation by departments or ministries at the outset stands in the way of building a base of co-ordination.

I believe it is accurate to say that there is no nation on the globe that has fully implemented a PPB system. I think it probably is accurate to say we do not even know how many issues within any single nation or any State would lend themselves to analysis, but they are in the thousands and thousands, and no nation has the staff devoted to this to undertake the job once a year, or even once every five years. It is going to be a while before we really understand about programme outputs, governmental products and the way in which they are produced.

What we essentially are building is an iterative process. We move forward in steps, we question and question again, revise and question again. I have been asked repeatedly whether PPB is working. This seems to be the primary question I am asked. My answer is clearly yes. There is a new set of questions being put, throughout our nation at least, and that is: We are spending money, we are spending resources, with what result? Now, that is one major difference. The question has been altered, for example from size of class to reading achievements, from teachers' salaries to student attitudes. It is a very different set of questions.

The second consequence has been comparison of costs where programme results would appear to be the same, or similar.

The third consequence is a request for options, alternatives, and the fourth, the opening of the door in a major way for social invention.

Now in the paper that I gave you for this meeting I had a set of materials designed to show the documentation of PPB. I believe on page you have a table that illustrates the components, the documents and processes involved. As you can see, the component elements I have labelled 'structural' and 'analytical' and, included as well, the evaluative process. Under 'structural', we have a set of tools. The first is that famous statement of objectives which was repeated throughout the conversation last week.

Now may I say a few things about the statement of objectives. The first thing is that objectives for this purpose have to be operational. And what does operational mean? It means it has to be measurable.

A second characteristic of the problem of objectives in this framework is what I choose to call the 'up and down' problem. Who formulates the objectives? Is it formulated at some global level, or are the objectives synthesized from a set of statements of purposes down at unit, agency, bureau levels? There are arguments that run both ways, suggesting that we need both. We need somehow to elaborate and enunciate the larger objectives of a government as a whole. And we need also the 'up' process because some governmental official has to be responsible for whatever unit of outputs we define at the lowest elemental level. If you do not have someone responsible for output, then there is no clear way within the government of having the right amount of product produced in the right quality.

The third characteristic of outputs in the governmental sector is that they are generally multi-purpose. It is very hard to find a public product, a public service that has only one purpose. And you all know that in education almost every activity is destined to serve a variety of purposes. Accordingly, it becomes necessary to measure these multi-purposes.

The statements of objectives come to form the basis for a programme structure in a PPB system, and a programme structure is little else than an outline with large categories, sub-categories and elements in some high scheme of classification of what the government or what the ministry does.

The programme structure is a base for a programme budget. Now what is a programme budget? A programme budget is a programme structure in which items of budgetary expenditures are shown in accordance with the classification system.

In the governments within which we work we have urged them not to move on to a programme budget for the simple reason that at the beginning we are not quite sure how we would like to see these things locked in to a budget and we want to wait and see and change our minds readily. And if one starts to formulate a budget to present to the legislature or the parliament in this way, it becomes rather difficult to change.

There is another document that is produced in the course of carrying out a PPB system called the Multi-Year Programme and Financial Plan. Now a Multi-Year Programme and Financial Plan is a budget (a typed document), carried out for five years or so, both in terms of expenditures and in terms of output, so it is some summary measure of output.

For the governments as a whole it becomes a fiscal planning document, the macro document, because it shows, given the budgetary commitments made, the programme decisions taken, and what the financial consequences are in forward years.

Now there are two ways of displaying expenditures in a Multi-Year Programme and Financial Plan. One way is the way in which the British have done this, and which the U.S.A. does it too: we project on the basis of existing programme levels, costing out - in terms of prices ahead (in our case, not in the British case because they use constant prices) and changes in numbers of beneficiaries, for example, changes in numbers of school children. Now, this does not alter the programme, it simply re-costs an existing quantity and quality of public service in terms of competitive wages, price trends and numbers of children, for example, or numbers of people. Now there is still a different way and that is to build in alterations of programme levels, which I believe is what was done in France, for example, in higher education. A change in the proportion of young people going to the universities, and that is changing the quality or quantity of higher education.

Now the heart of a PPB system is not the structural documents. The heart of a PPB system is analysis and that is what makes it different.

We have broken down analysis into two parts, simply because part one, which is the problem definition statement, is very simple to communicate to people who have been working on programme planning in the government - they have no special background of competence for analysis.

Now the problem definition statement is essentially designed to define what the problem is. The intent is to ask: What is the real problem? Let me give you an illustration. We can say what we want is equal pay for women and men teachers, and the issue that we seem to have is to get equality of pay and then we probe the question: What is the problem? Why equal pay? What is it that we are after? And fairly soon we begin to see that what we are after is some balance between men and women in the teaching profession and we probe further, and we find that men produce a different teaching product. And so we now have a different product and different products sell at different prices. And we have moved away from the initial problem altogether to a different problem and this is the problem now of setting different prices for the different educational products of men and women teachers.

We ask, as I just did, what are the purposes? What are we after in trying to solve this problem anyway? And we are back again at this statement of objectives. We are also back at that other thing called criteria for measurement. How can we measure progress toward the achievement of those objectives? Then we also ask: What is now going on in this that has a relevancy for this problem? How many men teachers do we have, how many women teachers do we have, for example?

Where are they? Whom do they teach? What do we really know about differences in impact? Let me say in a different way that Socrates is living again in a PPBS system because it is a very 'Socratic' process of question asking.

Now another facet of a problem definition statement is to identify factors that fall outside of the evaluation criteria, such as what are the important political issues involved in this question. Will we totally upset the labour unions with a differential product, not equal pay for equal work? Who are the vested interests at issue and what are their views likely to be? Then we ask even in the problem definition statement for identification of options, alternatives. And we close the problem definition statement with the recommendations that the staff makes for follow-up research and work on that problem.

Now I would like to discuss the components of a cost effectiveness analytical document. The first part is similar to the problem definition statement because the problem definition statement is really the first part of analysis, and in many ways the more difficult part. I will run through the components with you. First is the definition of the problem, the second, the identification of objectives, the third, is the familiar criteria of measurements, the fourth is identification of options or alternatives, the fifth aspect is an analysis of costs - that means total costs, whether or not incurred by a particular ministry or bureau, and it includes costs foregone in the private sector for example, and includes them not only for one year, but for a number of years out. The number of years is really defined by the nature of the problem. The cost analysis for all options has to be on the same time span, which means generally that economists tend to take these cost analyses and set them forth in terms of present value of the future cost stream so that they are all set down on a comparable base. Some of them may involve capital outlays that extend out for 25-30 years, whereas others may not call for investment of this kind. The sixth is the measurement of effectiveness in terms of social and economic effects. And the seventh is a clear statement of trade-offs among options, which is not easy when your measurement of returns are not comparable to the measurement of costs. I will show you how that works in a minute.

We then need some statement of uncertainty. How good are these estimates that we put in with respect to costs and effects? What is the range of uncertainty? By the same token, we ask for an identification of the assumptions that have been made and the sensitivity of the total analysis to those assumptions. Last, we want documentation that will give everyone an easy access to the materials that have been assembled.

Now, perhaps the most important piece of this whole exercise is documentation, because the documentation raises the level of discussion and consideration. As one who has made estimates on backs of envelopes and answered telephone calls on costs of public services, let me say that any staff person welcomes the fact that no one can ask for these numbers five minutes before.

Now let met give you a little feel for this problem of tradeoffs when the results are expressed in non-comparable terms. So that I will have no debate, I am not going to take education as an illustration. Rather I will take health, or highways.

Let me assume for the moment that the objectives of a road building programme are something like this: safety, speed, appearance, pleasantness, and economic development. Economic development has to be defined and we will define it in terms of changes in income and changes in employment, so we can measure it. Thus we have a series of programmes - options A, B, C. Now just for the moment, let me say we will assume that option A is negative on safety, neutral on economic development and plus on speed. And option B is neutral on speed, is plus on economic development, neutral on safety and minus on appearance. Now these would have quantities, not pluses, minuses and zeros, but even minuses, pluses and zeros are not useless.

Now, as you see, these have different criteria and they are unweighted. Now how does one trade-off one to the other? Having put cost down, and I am assuming for this moment that all of these cost the same amount, what has happened? For one thing we know immediately we have made some bureaucrat's life much more complicated, he can no longer say yes or no. But I will tell you what else we will do for him. We will put together material on the political aspects and the pressure group interests, so when he has to fight through this issue in his mind he will know ahead of time what the various vested interest groups' reactions are likely to be. Now that seems to me to be extremely important for someone who has to make these harder decisions.

Now a word on my favourite part of PPB before I close, and that is on the problem of social invention, innovation. Very often last week I heard of the importance of change. Change alone is not really what we want. We want change that will make things better, however we define better. And so what you need is a mechanism in government that will encourage and stimulate ideas and provide a means by which they get to be examined promptly. Programme analysis is that need.

There are various kinds of options that get to be generated. There is the kind of option that derives itself from the system that is being investigated in the analysis. For example, if one were considering a programme in education, it is very likely that the system might include: the pupil, the parent, the school, the teacher, the school administration and whatever is the over-riding centre of school administrative policy-making, or planning agency.

So we ask: What is it that we can do about the pupils that will produce for example more educational output? What is it we can do about the parent that will produce more educational output? What is it that we can do about the school that will produce more educational output? And so on. We are asking now for changes in the components of the system and then we also ask within the logic of the system's analysis: At what level? How much? For example, if we were looking at the school, we might say we want to increase the hours during the day from 6 to 7, from 7 to 8. We might want to reduce the hours to 5. Or, instead of increasing the hours, we want to increase the number of days, or we want to increase the schooling period, that is, we begin with younger children or we go on toward older children. Now all of these options are within the logic of the system itself.

There is another class of option that I call the option in the public domain, and that is an idea that has been brought forth about education. In our country now it is the placing of a price on education and freeing education from the public monopoly that it has been. This is a big option in the public domain.

And then there is a third kind of option that I call the new idea, and that is a totally new invention or the adaptation of an existing idea to a new thing. That is very hard for me to illustrate because new ideas come so scarcely and I do not have one to produce at the moment, but in any case it is a totally new idea. Now, if any of you have tried as I have to introduce new ideas into the government, you will know that there are stone walls in existing systems. There is a stone wall not only in the government, but also in the private sector to many new ideas.

But we now have a system that routinely asks for options and that system can be made to work, to feed in ideas and to get those ideas analysed promptly. And it is not just that we have ideas for change, we have to be sure that the change that is wrought is that which we would like to see in terms of the purposes to be served.

RATIONALIZATION OF BUDGETARY CHOICES IN EDUCATION (The Case of France)

by Michel Pineau

Educational planning is nothing new in France as the 'Plan d'Equipement' has been taking this need into consideration for more than 20 years now. However, in the preparation of the first five plans, the work devoted to education - as with collective needs as a whole - was exclusively directed to projections of necessary equipment. The forecasts themselves never served directly as elements for taking decisions with regard to budgetary allocations designed, classically, as an apportionment of financial availabilities among administrative entities. This way of working hardly made for a clear definition of the education system's objectives or for the implementation of a sustained policy of educational development.

The preparation of the Sixth Plan (which will cover the period 1971-1975) is already a distinct step forward, since the:

> "concept of collective responsibility makes its appearance for the first time ... This evolution in terminology interprets the determination to widen the field of planning. Actions by the State and by other public bodies which tend to satisfy collective needs should henceforth be perceived in all their aspects. Commissions will be asked to study, in the first place, the objectives of the policy to be pursued in their own field of competence in relation to the trends and tendencies revealed by long-term work and by a precise report of past development and of the current situation. Additionally, they will be required to study the various ways and means which may be employed with a view to attaining these objectives."[1]

The guidance given by the Commissaire Général of the Plan as to the work expected of the commissions in singling out objectives, the study of ways and means available, and the estimate of costs, underlines the solicitude to see an effort made to "increase the efficiency and rationality of public intervention". Nevertheless, the organization of the work (conferring authority and powers on the various commissions is more nearly an administrative than a functional distribution), the relatively short time limits, and the lack of information regarding the methods to be employed are such that real over-all planning of the educational system is still far away. Further on, a return will be made to the studies carried out within the scope of the Sixth Plan and the results obtained or expected to be obtained.

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[1] Methodological note destined for collective function commissions. Commissariat Général du Plan, September 1969.

In these circumstances - and rather paradoxically so - it is in the classical ministerial departments where methods for rationalizing budgetary choices (R.B.C.) are making headway, that the best approach to the problem of educational development may be expected in the immediate future. Thus the Ministry of National Education includes teams of analysts specialized in the methodical preparation of decisions and the drawing up of budgets for programmes. Other departments which are creating similar services will be called upon to participate in working out the national educational policy, i.e., those responsible for problems regarding employment of manpower, professional training of adults, specialized teaching, and cultural and artistic development.[1] Within its forecasting department, the Ministry of Economy and Finance has carried out certain fundamental research and, following this work, continues to provide methodological assistance which, in accordance with French tradition, should then gain recognition through example and conviction rather than by coercion.

Particulars of achievements and projects will be given following a brief description of the principles governing rationalization of budgetary choices (R.B.C.)

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[1] These are, respectively: The Ministère du Travail, de l'Emploi et de la Population, Ministère de l'Agriculture, Ministère de la Défense Nationale, Ministère des Affaires Culturelles.

I. PRESENTATION OF R.B.C.

Justification for the rationalization of budgetary choices (R.B.C.) obviously resides in the ever-present fact that limited resources have to be apportioned (whatever their importance) among needs whose total equivalent is very much in excess of the resources in question. Necessarily, therefore, choices must be made and they are made at two distinct levels.

- choice of the objectives one wishes to attain, and,
- choice of ways and means for attaining objectives regarded as priority items.

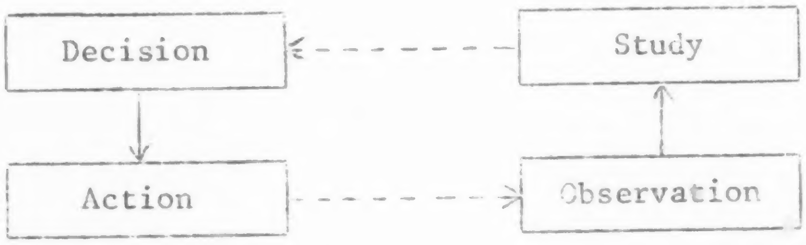
In actual fact, these two choices are not independent of each other, logically, they may not be dissociated in taking a decision where the result will be a programme (or an over-all group of programmes). A programme is nothing more than the simultaneous definition of an objective and a series of adequate means for attaining it - along with an appraisal of the cost of these means, plus particulars of the criteria by which the effectiveness of the programme may subsequently be judged.

Methods for rationalizing budgetary choices

R.B.C. may be distinguished by three essential features:

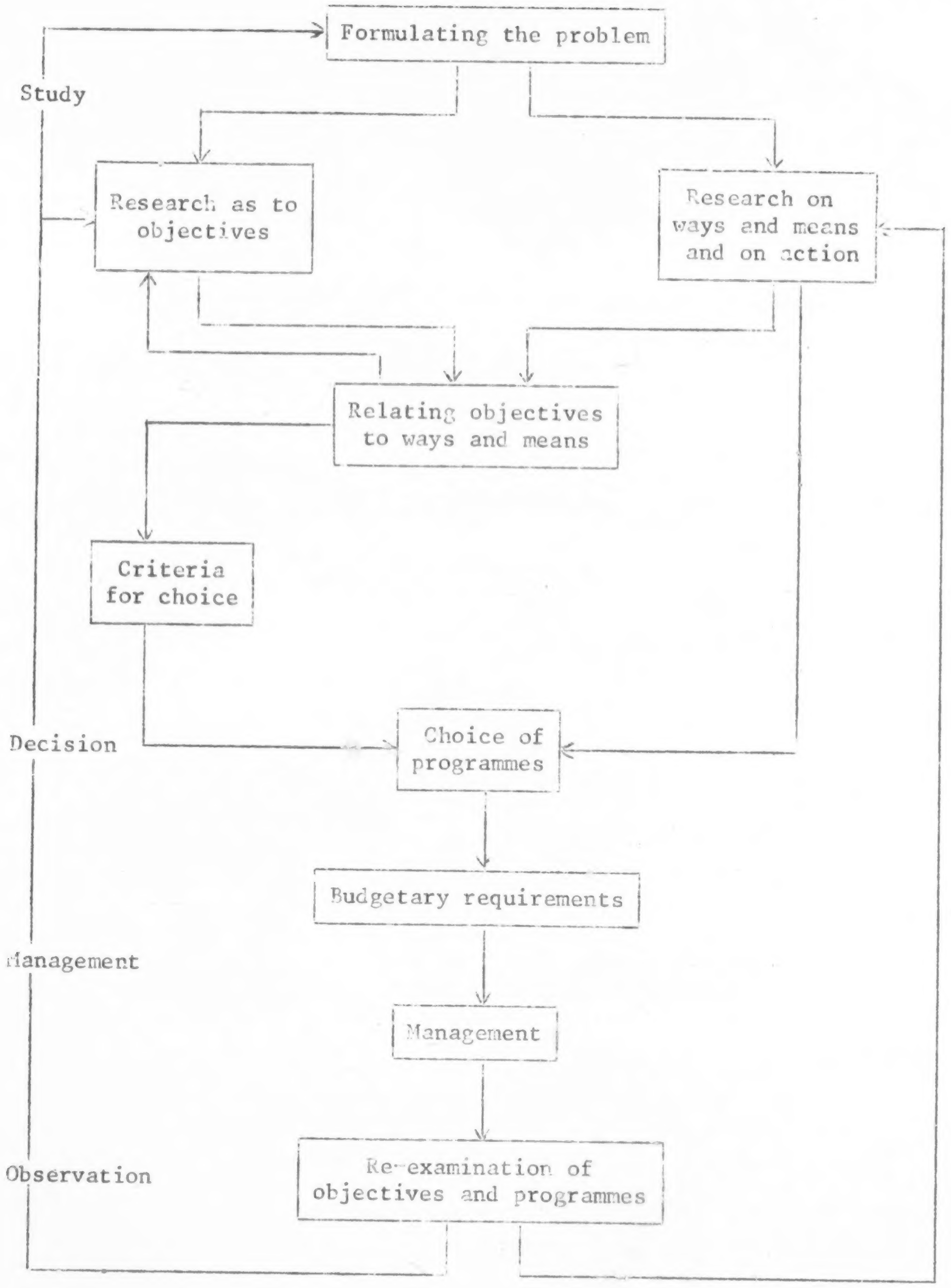
(a) The systematizing of rational procedures for arriving at decision

The preliminary study, decision, action, and observation of results should inter-relate according to the following pattern:



While the logical sequences indicated by the vertical arrows may be fairly easy to obtain there is, too often, a considerable effort required to impose the relationships between studies and decision on the one hand and action and evaluation of results on the other hand.

R.B.C. Circuit


Formulating the problem
Study
Research as to objectives
Research on ways and means and on action
Relating objectives to ways and means
Criteria for choice
Decision
Choice of programmes
Budgetary requirements
Management
Management
Observation
Re-examination of objectives and programmes

(b) Application of more or less specific techniques

These, ordinarily, are classified according to the phases in which they are mainly applied, although the borderlines are not always clearly defined.

(i) Descriptive techniques are most important for preparing information and for defining the problem's operational parameters and its variables: analysis of structure, the 'Delphi' method, nomenclature, etc.

(ii) Model and pattern techniques give a portrait of the real situation and permit actions to be related to their effects. In addition to actual models as such, simulation and elaboration of scenarios are also used.

(iii) The purpose of evaluation techniques is to allow activities and programmes to be classified and also to allow the use of an over-all rule for choice; evaluation of costs, of benefits, effectiveness, clarifying choices in view of numerous criteria, etc.

(iv) The aim of management techniques is to ensure that a programme is executed in the best way possible, i.e., to make provision for the resources and the times required and to adjust these to the resources and times required for other programmes, to control the execution just as much in relation to the objectives as to the resources employed, essentially, the methods resorted to are administrative payment orders and analytical accounting procedures.

(c) Development of inter-relationships and motivation for new approaches to problems

The strong purpose is shown by the activity of multi-disciplinary teams, by the constant search for dialogue between the experts carrying out the studies on the one hand, and the political decision-makers and administrators on the other hand and, finally, by the implementation of a spirit of innovation and experimentation.

R.B.C's contribution

Having thus broadly outlined R.B.C's main features, it is appropriate to stress the innovations introduced by this type of study.

The first is the close collaboration - required by the use of the method - between analysts and those making political decisions during the study and decision-making phases, and between analysts and those charged with administration as regards the study and the process of implementation. It is this parallel dialogue which guarantees that the results of the study will be translated into decisions and will definitely be implemented.

The second innovation which the method of analysis carried with it is continuity of the study and decision process. The integrated circuit 'observation - study - decision - management' shown herein is an example of this feature.

Another original feature is that each phenomenon is placed in its proper context by examining its numerous aspects through the use of various disciplines. This over-all way of viewing phenomena makes it possible to define the behaviour and motivations of the different agents and the consequences of possible actions.

Different types of studies

Under the one common title of R.B.C. the French administration carries out several types of operations. The two principal ones are as follows[1]:

1. The first is to seek over-all clarification regarding administrative actions by classifying all the resources used within the framework of missions which have been accomplished, i.e., by making breakdowns of expenditures per objective and no longer by type. In

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[1] A third category may include operations which are not exactly R.B.C. operations but which are often necessary preliminaries: organization, modernizing of management, particularly via data processing, decentralization and delegation of authority, modification of control procedures, etc.

other words, the object is to present the budgets of the administrations according to a structure of programmes. This requires the co-ordinated development of a series of actions for the setting-up, execution, and control of the budget. It entails going beyond the distinctions between services voted and new measures, between investment expenditure and operating expenditure and it also requires that expenditures by administrative units collaborating in the attainment of an objective be re-grouped for each objective.

The following belong to this category of studies:

- basic studies on the setting up of budgetary nomenclature, of grids for transitions between programmes and between administrative units, and of accounting systems
- working out of programme budgets affecting a ministry department or, at a lower level, a directorate or agency.

2. The other type of study consists in estimating the economic and social return of public actions so as to clarify the choice of alternative policies.

It is these studies that make special use of cost-benefit analysis and techniques of multi-criteria comparison. They are normally brought to bear on precise and limited projects. Without minimizing the first approach, whose result (programme structure, budgets worked out per objective, etc.,) has to be used as a reference point for the specific studies of the second category, great importance is attached to these studies since they make it possible to:

- clarify certain very important problems
- focus the efforts of study and implementation on actions with the highest return, and,
- to obtain partial, but concrete, results whose obvious value should encourage prompt adoption of such rationalization methods for budgetary choices.

It goes without saying that projects which will become 'pilot' studies must be chosen judiciously with regard to their anticipated effects (budgetary impact, sensitization of opinion ... etc.) and to the feasibility of review by teams of analysts.

II. APPLICATION TO EDUCATIONAL PROBLEMS

The contribution which R.B.C. makes to solving educational problems is, as yet, modest.

Nevertheless, for R.B.C. this is a worthwhile field of action. First, the budget allocated to education is enormous, the National Education budget - to which is added the fraction of expenditure devoted by other ministries to educational activities - runs to 20 per cent of the State's budget. Furthermore, account should be taken of expenditures by local communities as well as those by families and firms. Additionally, education is not only of vital importance for the economy as a whole but it is directly geared to society as such, and to each individual person. The impact on public opinion of an action in the educational field is, therefore, considerable. Finally, education considered as a productive activity seems to use a very complex technique dealing with inputs which are both numerous and finely varied. The search for and evaluation of the best combinations of resources should have great effect on the efficiency of the system.

Studies carried out

The main work carried out to date consists, on the one hand, of studies of a fairly general nature as to the objectives of education as well as the characteristics of the educational system and, on the other hand, a functional approach to expenditure which is basic to the subsequent development of budgetary studies.

1. Studies regarding objectives have necessarily been carried out by the Education Commission preparing the Sixth Plan. On the level of essential objectives the Commission has merely specified once more the conclusions at which almost all studies arrive, whatever the country or researcher conducting them, and has reaffirmed the following:

- the concern for adaptation to the economic environment, particularly through knowledge of vocational opportunities and the adequacy of training and specialization, with insistence on the role of permanent education in a society where job mobility is tending to become the rule

- the research aimed at raising the average level of culture
- education's social role which promotes participation in the life of the community but which is also - and probably mainly - one of the principal factors in making for equal opportunities for all.

This latter aspect has, quite properly, been given much study and the Commission's report stresses that the educational system should not be content with merely correcting its inequalities (due to social origins, regional disparities and degree of urbanization, discrimination between sexes, etc.,) but should also make an effort to compensate for individual handicaps (special teaching for the handicapped and maladjusted, pre-school teaching, etc.).

Continuing its analysis, the Commission has - for certain kinds of education - fixed intermediate objectives to be retained as options of the Plan. For example, as regards elementary education, the following objectives are noted:

- training of all teachers in teachers' training colleges;
- systematic in-service training for teachers throughout their careers;
- obtaining better teaching conditions in two distinct aspects, i.e., eliminating over-crowded classes, and the consolidation of rural classes with small enrolments
- application of the so-called 'tiers-temps' (three-part) pedagogical method (general training, physical development, and social and cultural awareness),
- reduction of the repetition rate.

The foregoing gives the initial outline of a framework of objectives. The only regret is that it is not more systematic and more detailed.

Another study which is fairly closely related has been carried out by a team from the 'Direction de la Prévision' (the forecasting department in the Ministry of Economy and Finance). After defining

Some of the characteristics of the educational product

Objectives	Preprration for social life	Preparation for professional life	Transmission and enrichment of the cultural heritage
Acquisition of knowledge	- civic education (administrative and political) - home economics - social economy - foreign languages and civilizations - psycho-sociology - pedagogy	- basic knowledge (reading, writing, arithmetic, language) - general knowledge (geography, history, literature, exact sciences economics, foreign languages) - specialized knowledge (theoretical, technical, practical, artistic)	- diversified knowledge (scientific, literacy artistic, foreign) - participation in a sport (as an amateur) - artistic expression (as an amateur)
Development of attitudes	- critical faculty - openness to discussion and dialogue - sense of responsibility - solidarity, feeling for the community - tolerance	- aptitude for learning - adaptability to change - initiative, responsibility - team spirit	- research, discovery - inventiveness, creativeness - skilfulness

Remarks:

1. The knowledge and attitudes shown above as being necessary for each subject are not specifically restricted to such subject but especially concern it. As an example, an aptitude for, or openness to discussion or 'dialogue' is a useful asset in all walks of life but more particularly so in social life.
2. The characteristics given hereabove are merely intended as an example - the list given is far from being exhaustive.

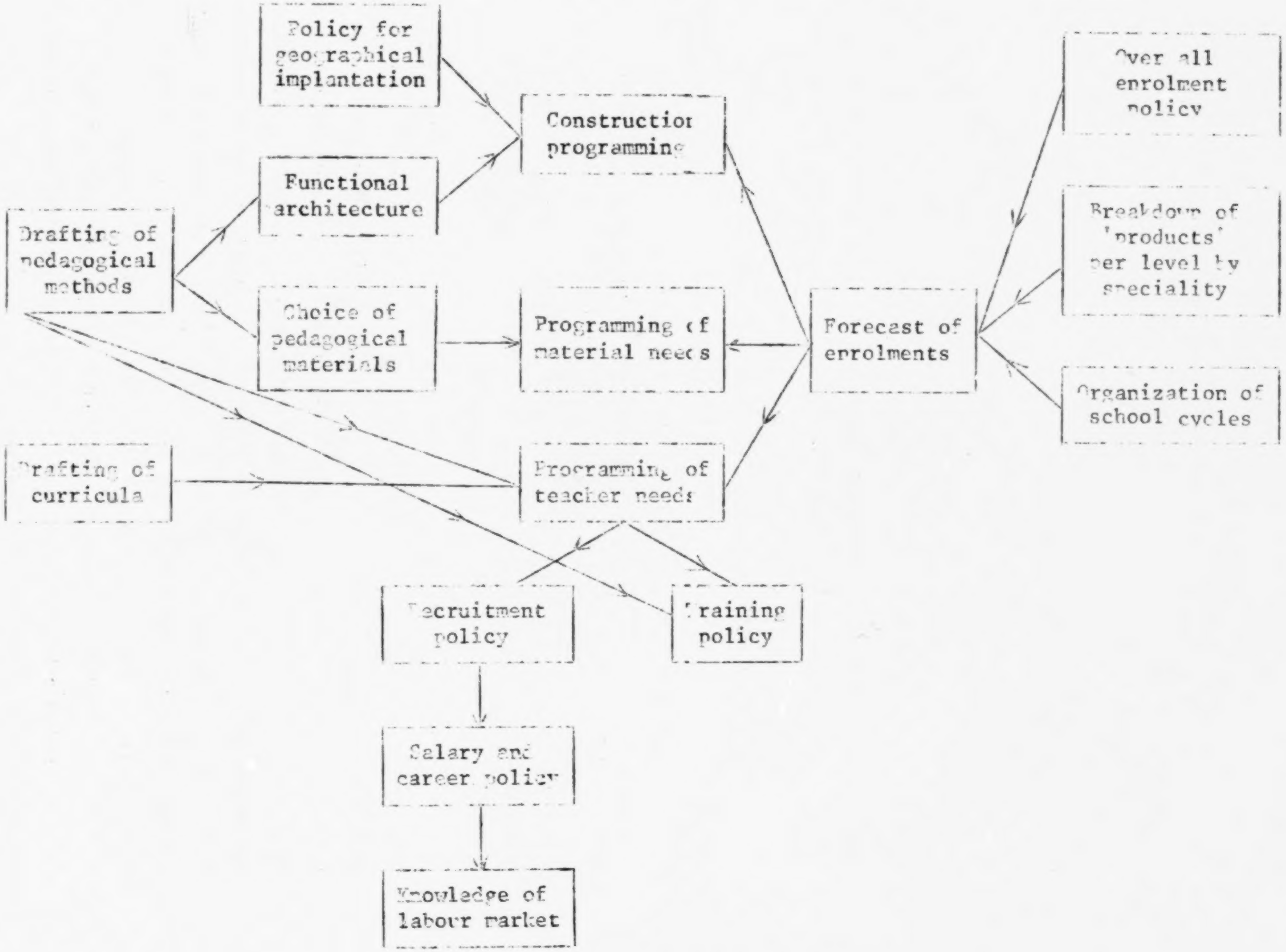
the objectives of education in exactly the same terms as those given by the Sixth Plan's Commission, this study considers the characteristics of the 'output' of the educational system. These elements could be judged by levels and, as an example, a table has been suggested for the degree of knowledge of a foreign language. The levels proposed would be:

(a) no knowledge at all,
(b) slight reading knowledge of simple documents,
(c) knowledge restricted to a particular field (i.e., a technical field such as petrochemicals),
(d) general knowledge allowing a person to make himself understood in the foreign country,
(e) knowledge in a particular field allowing a person to take part in a technical conversation,
(f) knowledge sufficient to allow bilingual exchanges.

The different headings which might lend themselves to this sort of classification are themselves classified according to two main functions, i.e., the acquisition of knowledge and the development of attitudes, and are applied by priority to one of the three major objectives of education. The list which follows will give a brief idea of the projected headings and their classification. (See overleaf).

Similar to these types of research is a fairly original experiment by 'Direction de la Prévision' to describe educational policy problems in analytical fashion. Taking its inspiration from an analogy between the educational system and an industrial enterprise, the research draws up a list of the main functions of national education and proceeds with an analysis in terms of sub-functions or of problems to be solved. It then makes careful note of the relationships existing between the two. The result may be in the form of a graph or curve corresponding to a logical and prior relationship of reciprocal functions. A partial example will better illustrate the principle of this analysis which seems to promise a valuable contribution for drawing up a framework for objectives.

Analysis of educational problems


Policy for geographical implantation
Functional architecture
Construction programming
Drafting of pedagogical methods
Choice of pedagogical materials
Programming of material needs
Forecast of enrolments
Over all enrolment policy
Breakdown of 'products' per level by speciality
Organization of school cycles
Drafting of curricula
Programming of teacher needs
Recruitment policy
Training policy
Salary and career policy
Knowledge of labour market

2. The second approach has already provided information regarding the structure of educational expenditures. These data may be used for economic studies as has been done in preparing the Sixth Plan. Above all, this is a first step toward the rationalization of budgetary costs, toward the drawing up of functional budgetary nomenclature and the organization of a network of accounting information which should make for better determination of costs, breakdown of expenditures by objectives and, in the long run, the design of programme budgets.

In the first instance, mention will be made of a series of tasks carried out by departments of the Ministry of National Education. These consisted of the breakdown of budgetary expenditure (sometimes of the over-all expenditures on education, i.e., including expenditure by other agencies, local authorities, firms and families) spread among the various types of education: pre-schooling, elementary, secondary (first cycle), secondary (second cycle, short or long), higher education and such related functions as: training of teachers, research, external aid and administration. Within these functional budgets - which are fairly condensed - the expenditures are also broken down by type, i.e., expenditures on personnel, operations, social assistance, and capital equipment. Generally speaking, these different headings are subsequently related to the number of students enrolled so as to obtain average costs per student.

For certain types of education and for certain types of expenditure, more detailed analyses will be found as, for example, in the flow chart on the following page which deals with the average non-teaching recurrent cost per student in the various categories of public secondary schools.

A further study on educational expenditure has been undertaken by the 'Direction de la Prévision'. The latter is examining a chronological series of budgets (1952-1969) and concentrating on the search for the factors governing the variations which have been observed. Then in accord with hypotheses regarding the future evolution of the

Non-teaching recurrent cost per student in public secondary schools

	Expenditure on personnel					Expenditure on material and operation								
Secondary schools	Management	Admin. secretariat etc.	Social-medical services	Supervision	Total I	Food and lodging	Heat and light	Laundry	Rent	Upkeep and maintenance	Transport	Others	Total II	Grand Total (I + II)
State lycées - classical and modern														
Nationalized lycées - classical and modern														
State lycées - classical, modern and technical schools														
Nationalized lycées - classical, modern and technical														
State technical lycées														
Nationalized technical lycées														
State secondary colleges														
Technical colleges														

factors brought to light (for certain of these one may use only hypotheses which are either qualitative or merely indicative of a trend - hence the interest in the method) the study offers a projection of budgetary expenditures up to 1975. At this point, a notion is introduced which is shown very useful later in over-all projections of expenditure, the notion of a 'student-unit' which comes from the observation of a constant ratio over a period of several years among the average expenditures per student in the different types of education. For example, at the present time while a student in elementary schools costs 100 in the budget, a student in secondary schools costs 300 and a student in higher education 500 - hence the idea of costing an elementary student on the basis of 1, the secondary student at 3, and the higher level student at 5, with the common unit being a hypothetical 'student-unit'. At medium and long term, these ratios tend to change and the present trend is towards an increase in the ratio between the cost of the higher level student and that of the elementary and secondary students. Thus, it is possible to take into consideration in 'synthetic' fashion and with a view to making projections for any given term, the evolutionary factors of specific costs of each type of education and such common factors as a re-evaluation of salaries or a reduction of teaching hours.

The projects

The rapid review which has just been made of studies using an R.B.C. approach to educational problems naturally leads one to hope that there will be more important developments in the near future. Indeed, as was stated at the outset, the spirit, the methods, and the personnel for R.B.C. are beginning to multiply within the various administrations and, as the field of education shows itself to be particularly appropriate, projects are now becoming both numerous and ambitious.

1. The 'Commissariat Général du Plan', as far as it is concerned, has included in the second phase of the Sixth Plan's preparation the study of several 'complete programmes'. By this it is meant, with

regard to an objective which has been well defined as to limits (and of a size appropriate to the dimensions desired for the study), the carrying-out of an advanced programming of material and financial resources, and subsequently the following up of the implementation of the project in a trial run.

One of these projects (not yet specified) will concern education.

2. The Ministry of Education, which has acquired extensive resources, has developed a very extensive programme of tasks to be accomplished.

All the tasks will not be embarked upon directly, although it is already certain that three main efforts will be predominant:

(a) the first will consist in a more detailed study of the functional analysis of the budget with particular regard to tracing the components from one educational department to another by training aspect - which is much nearer to a proper objective budget. However, the latter will only have operational value if it is accompanied by a defined battery of physical indicators. This is a task of major importance since all subsequent studies will make reference to these same indicators. The choice of the latter presents several difficulties since an indicator should be precise so as to be readily identifiable, sufficiently 'synthetic' as to have demonstrative value, and yet sufficiently limited so as to avoid being a consolidation of heterogeneous elements;

(b) the main effort will doubtless be upon specific studies which, as already stated, appear to be the most beneficial at short term. For the moment, several themes have been outlined:

- tests could be carried out - within the scope which includes the elimination of rural classes of small enrolment - on different possible systems which combine the establishment of pupil transportation and lodging facilities, and studies could be made of the problem of sharing the financial charges, resulting from the policy chosen, between the State, local communities, and families.

- the problem of short-term adjustment of school facilities to enrolment requirements brings into question the forecasting techniques to determine pupils' enrolment on the one hand and, on the other hand, the utilization, management and financing for supplementary mobile classes;
- experimental studies regarding a new kind of management of secondary schools are at present under consideration. The idea is - by re-grouping such establishments in school districts - to discover the optimum size for the basic administrative structures needed.
- more efficient use of premises and educational resources will be sought in extra-curricula activities, e.g., evening classes, cultural activities, etc.;
- another theme has been taken up for which implementation will be rather more delicate since it mingles pedagogy with economic and technical problems. This study would start off with an examination of the pedagogical and economic uses of textbooks on the one hand and audio-visual material on the other hand. Then it would compare the various possible combinations of pedagogical procedures, i.e., teachers, books, and the audio-visual methods;

(c) the third effort would involve a grouping of studies in fields which could later become the subject of 'pilot' projects of much importance. Three subjects are proposed:

- to draw up the balance sheet of compulsory schooling up to the age of 16 years: appraisal of the costs of such a measure, enforcement as of 1967, and comparison with the advantages expressed in terms of the number of pupils enrolled, vocational guidance of children, available education for older age groups, modifications in the labour market, etc.

- to analyse present costs of higher education and consider the means of financing it with a view to implementing autonomous administration of the universities.
- to study the costs of different training sequences for secondary school teachers and to define the criteria for measuring efficiency.

Finally, it appears that the primary preoccupations in the approach to educational planning by R.B.C. are, most logically, the definition of objectives, the collection and ordering of costing data, and research for indicators which will allow an appraisal of economic and social efficiency. The studies presently being carried out, or under contemplation, are certainly heterogeneous as regards the subjects considered and the techniques employed. Quite obviously this is indicative of a methodology still in its early stages. It is also, however, the expression of a determination not to leave unexplored any of the possible avenues leading toward improvement of the educational system.

Today education is being transformed by two forces beyond its control. One is the emphasis on modern management which stresses relevance, efficiency, and modern management techniques. This tradition has emerged from the heart of the power structure of the Western World, from the corporations and the defense departments, accelerated by the public demand for more education and lower taxes.

The other force is a new world culture which can be found in every continent and every nation. This force finds its strength not only among young people and peace groups, but in new forces in the church, those who advocate human brotherhood, and with those who would attempt to have man make his peace with the natural forces of this globe. At present, moving from quite disparate political and social structures, those forces are destroying the education traditions of an industrial age and contesting the future of education in every country on the globe. Within five to ten years, I believe that these forces will join in a new creative synthesis that will transform both education and our world more than it has been changed in the past century.

Education management

Recently Robert Finch, when he was U.S. Secretary of Health, Education, and Welfare said:

> "Here we are spending all these hundreds of millions of dollars on all these programs and we don't know really what works and what doesn't in education ... (We are) just trying to shake up the existing establishment, make them realize that the old ways aren't working anymore, particularly elementary and secondary education.
>
> They're still doing things they did 40 years ago. They're not responsive to television at all. They just ignore the fact that a child has spent three of four thousand hours sitting there, absorbing a lot of unrelated data. We have got to get them to alter their viewpoint."

Mr. Finch's views are shared by a growing majority of citizens, not only in the United States, but throughout the world. The education system is not providing effective education to the students who attend school.

In 1963, President Kennedy was disturbed by a report that nearly half, 49.8 per cent, of the men appearing for military service were judged unqualified for service, and that one man in four, 24.5 per cent, lacked the intellectual skills to absorb military training within a reasonable time.

> "The most common deficiency," President Kennedy said, "was apparently that they could not read or do simple arithmetic."

The world investment in education is about $140 billion per year, of which nearly half is spent in the United States. It is amazing how little we know about the results of this massive investment. The truth is that very few education leaders know how effective or ineffective their education system is.

Everyone thinks education is good, but no one can define it.

Everyone says education is essential to economic development, but no one can define the relationship between education investment and economic development.

We announce the number of high school graduates, but in the United States, there is evidence that probably 15 per cent of the high school graduates cannot pass fifth grade reading and mathematics tests.

We talk with pride about the graduates of various vocational training programmes, but are silent about the success of these graduates in obtaining the jobs for which they are trained. No school system has organized a programme to measure the post-graduate careers of students as a basis for judging school performance and changing school programmes. Schools, which have emphasized the responsibilities of the students until now, have successfully rejected any concept of accountability for their performance. No one prepares report cards for schools or teachers.

MANAGING EDUCATION FOR THE FUTURE

by Arthur Barber

Until recently, education has been a system dominated by tradition and custom. Education plans consist of a list of the schools to be built, the number of teachers to be trained, and the number of textbooks and children in the school. These activity reports provide no information by which to judge the performance of the school. The revolutionary concept which I advocate is the management of education: the definition of educational objectives, the measurement of performance, and the control of costs.

One of the examples is the performance-based reading and mathematics programmes which we have assisted in establishing in schools in Texarkana, Texas, and Gainesville, Georgia.

During the past two years, our organization has established the first arrangements in the United States in which the public school system contracted with industry on a guaranteed performance basis to teach reading and mathematics. In both cities, the students who participated were selected by the local school system and tested prior to entry into the programme. The education programme is under the control of the educational contractor, the students are taught in relatively small classes, and they are regularly tested for their achievement. To assure that the children really learn reading and mathematics, rather than the taking of tests, a battery of several tests is used. In our opinion, the programmes have been quite successful. After 60 hours of instruction, students have shown average gains of 2.2 grade levels in reading and 1.4 in mathematics.

The cost has been between \$80 - \$150 per grade level achievement per student in these subjects. The government will have established comparable programmes in 24 school systems by September 1970. These programmes will have approximately 14,000 students. When you realize that many elementary schools in the United States operate at a cost of \$800 - \$900 per student year, and often do not achieve one grade level advance in reading and mathematics, the tremendous benefits of such programmes can be recognized. As these costs are primarily for the wages of teachers, the costs could be sharply reduced in developing nations.

If the principles of accountability and performance measurement are accepted by an education system, major educational reform and increase in efficiency will follow. If accountability and the measurement of performance are not accepted, new technology and incentives will not be widely accepted whether or not they prove effective. For that reason, a performance-based education system can include provisions for schools to introduce the principal of accountability into their organizations and programmes. There are three factors which are fundamental to the concept.

(a) The nature of the written agreement among the schools, the teachers, the students, and any advisors

Every performance incentive programme is defined by written relationship involving a statement of objectives in terms of specific behavioral change as measured by certain tests, and an incentive scale which ties performance to achievement measures.

In turn there are explicit agreements with the teachers and children in which each teacher is responsible for the learning achievement of certain children. Each child has an equal opportunity to learn and is responsible for his achievement. This allocation of responsibility and accountability is relatively unique in the field of education and is a major factor in increasing education efficiency whether or not incentives are used, e.g., if salaries of teachers were constant, accountability would probably still lead to significant change in behaviour.

(b) The measurement of performance

The introduction of performance-based education systems is causing a major re-examination and re-design of tests. The first and most immediate effect which is obvious now is the question: Is the teacher teaching reading or teaching how to take a test? This problem can be resolved through appropriate selection of tests.

A larger and more important effect will be the shift in parent/student objectives as performance education systems succeed in achieving their objectives. For example, parents want their children to be able to read to the degree that they can pass a civil service or armed forces or education reading test. As performance education systems develop that skill effectively - there will be a greater awareness that reading skill does not imply the ability to speak or write coherently. Inevitably students and parents will complain and performance education systems will be extended to include speaking and writing skills.

A major factor in accountability is the use of the measurement data. For example, some school principals have large charts on their office wall - an implied evaluation of teacher performance that apparently has a significant effect. The development of effective measurement standards is essential.

(c) The question of individual motivation or motivational reality on the part of the school administrator, the teacher and the child

The simple motivation model of the performance based system suggests that each has a cash incentive to teach the child to gain the highest possible score on a reading or mathematics tests. In fact, the motivations of the administrator, the teacher and the child are very complex. The administrator may be seeking a promotion to another city; the teacher may be marking time until her baby is born; the child may be in school because the school officers made him come and he is just waiting to get out and earn some 'real' money. In short, the theoretical model is only an approximation to human behaviour. One of the principal tasks for the administrators of performance-based schools is to align the motivations of staff, teachers and students. This requires an understanding of the factors affecting their motivation and performance such as their perceptions of their role, their individual objectives and their 'feelings' about the environment in which they work and learn.

By focusing on the desires of the students and parents to learn, we have consciously by-passed many sacred cows of traditional education.

- Teachers are hired or retained or receive high wages because they are effective teachers and not because of any special credentials or extra training programmes.
- The child is in class a few hours, long enough for him to receive individual attention. Time and money are not wasted in spending long hours in large classrooms maintaining discipline.
- Very little money is spent for building costs. The true costs for housing are included.

I believe that we could improve the efficiency of educational investment tremendously simply by abolishing compulsory school attendance and planning small group education periods.

Despite the success of this limited programme, we have faced major problems in gaining acceptance of these new programmes. The U.S. federal government and philanthropic foundations have pumped billions into programmes to improve and change education, but even the most wildly optimistic observer would have to say that the results have been modest or non-existent.

The reason is fundamental:

(i) the school measures its students and itself by irrelevant measures.

(ii) the education of educators is not less than 20 years behind the times, and often 40 or 50 years.

(iii) the education system has no generally accepted procedure for selecting, rejecting, and implementing new programmes. For a century, education has produced research people or practitioners and never managers. Management is now penetrating educational conversation and even some educational practice.

However, management techniques without purpose can be a disaster. The most obvious example of the moment is the policy planning and budgeting system. This intellectual fad based on the so-called 'success' of the American defense department is very likely to cause more problems than it solves for schools that are adopting it unless it is accompanied by comprehensive review of goals and procedures. The implementation of policy planning and budgeting systems has obscured rather than illuminated the long overdue re-examination of the goals and the establishment of performance criteria for the U.S. defense department. The introduction of policy planning and budgeting appears to be postponing the overdue reassessment by the educational institutions which adopt these techniques.

When we know what our goals are, and recognize our efficiency in achieving them, we will have a basis for judging the nature and character of the necessary educational change.

We use the following measures which we consider fundamental to the management of education. For measurements of relevance:

- Access: the percentage of school-age population in a school district compared with the number of children of the relevant age group who are being educated. It includes both drop-outs and children who have never been to school.
- Post-education career: this would involve measurement of a sample of students after they left school to determine employment, wages, and social and career patterns.

For measurements of efficiency:

- cost per student year,
- cost per student graduate,
- cost per student achievement.

The cost per student achievement - can be applied to any educational goal which a school system sets for itself and which can be measured. The objectives and measurements in different societies and cultures will be quite different. However, the cost per student achievement remains a useful concept in any educational enterprise.

To be fair, I will outline the type of educational programme which I envisage.

Education should provide reading and arithmetic skills and a trade to everyone. It is impossible to provide equal opportunity for all because accidents of birth, income and culture determine limits of human capability.

The education programmes which I would propose are:

(a) basic curriculum: this would have as its foundation reading and mathematics and would extend to any desirable subject in which it is possible to design an objective test that can be scored automatically, with questions to which there are definitive answers.

(b) self-expression: essays, games, painting, political debates. This is the area where a teacher-tutor is indispensable.

(c) vocational training: this would include industrial training apprenticeship.

I believe this type of programme can be established at a cost less than present education programmes. Education is the last of the manual trades. Within the decade, education will undergo a revolution by-passing the industrial age and leaping directly into the information age. The knowledge is available to do so now, all that is needed is the will and political leadership.

Children can be taught at play or by machines any information that can be recorded. These techniques will soon become available at very low costs. Multi-channelled television will be a critical element in this peaceful revolution. Today it is possible to install a 24-36 channel television system in any large urban area. The costs are $110 - $115 per family or classroom in the United States. In the United States individual instruction in cities could be provided at 30-35 cents per student hour. This cost is approximately 25-30 per cent in equipment and 75 per cent labour. Therefore, in developing areas, costs should be less. Furthermore, such systems can be built by private capital with profitable enterprises which will provide free channels to the school system. This opens up the possibility of television computer-assisted instruction at lower cost than present teacher instruction for basic skills in any urban area in the world.

To date, programmes have been developed which are effective and which do teach children, but the bottleneck has been caused because each system required a computer with the communications system, and as a result unit costs were increased and not decreased. A time-shared computer in a city with a cable network can teach basic skills at a cost less than current education costs in the western world. Perhaps more important, these costs should go down in the future.

Education and politics

Every educational system transmits cultural, political, and moral values. In most of the western world, by either dogmatically transmitting a single set of values established by the State or denying the transmission of such values, education systems have hindered rather than helped children in developing judgment with which they can grapple with difficult moral issues which the school cannot foresee. The issues that are of the greatest concern to young people are precisely those issues that are most likely to be forbidden in the school, such as wars, birth control, population problems, the legitimacy or illegitimacy of local governments, economic injustice in their community, human brotherhood, and racial discrimination. Many children have learned that stated ideals of their society are often not the true operational bases of government or corporate policies or programmes. They are not encouraged to discuss these discrepancies in school.

The school system considers itself to be the evaluating mechanism which determines young people's future role in society. The school system inculcates its own acceptance; we have all been trained to believe that anyone with more education or better grades has superior status and will obtain a better job. This is no longer true. Dropouts are being admitted to Harvard and Ph.D's from MIT cannot find jobs. The school which in the last century helped to train peasants and make them industrial workers has now become an increasingly ineffective defender of the industrial age and the status quo.

It is deeply disturbing to consider the possibility that education traditions and education credentials earned with hard work and considerable experience prior to the space age may not be relevant to the education of children for the future. The possibility must be faced.

Toward a human future

I have suggested an approach to the solution of some of our major problems in education: a comprehensive re-examination of goals and the achievement of these goals through accountability. The education manager can no longer assume the goals of the past are the goals for tomorrow, that student achievement will be measured by algebra problems solved, or the repetition of Newton's Laws of motion, that achievement is measured to determine if the student has achieved the programme objectives formulated many years earlier. Our approach places a much higher premium on questioning, assumptions, experimenting and self-awareness and the early detection of the consequences of one's actions with a consequent readjustment of one's plans.

Throughout this discussion, my words may have appeared cold, efficiency-oriented and ruthless.

I would like to suggest however, that we should make every effort to make education human. Paradoxically, I believe the efficient use of machines may make education humane. Humane because they should remove the teacher from dull repetitive tasks and shift the role of the teacher to that of tutor - the senior advisor in exploration. The need for change is illustrated by a story told by a teacher in kindergarten.

When the children came to class for the first time - the teacher announced that the class would draw flowers. Many children immediately began drawing flowers in many colours and hues. After straightening her desk the teacher announced - "the leaves will be green and the flower red". The children learned - sometime later when a substitute teacher had the class - she announced that the children should draw flowers. When no child began to draw she asked why - finally, a small child asked, "what colour are your flowers, teacher?".

All of us are committed to developing better educational systems to prepare young people for the future. There is only one thing wrong with this concept - we have no idea whatsoever of what the future holds for the young people who are now entering the school system. We do not know what we will need, and if we were honest, we would admit that we do not know. Fearful of admitting our ignorance, we mask it in cliches, phrases, and so-called 'professional terms' such as educational enrichment, curriculum development, relevance, and efficiency. Education seems to be in the hands of technicians who have long since lost sight of the goal.

The goal of education is the fullest possible development of the individual. We have not and never will fully achieve this goal. We can however, make a dramatic improvement. As John Kennedy once said, "Those who make peaceful revolution impossible, make violent revolution inevitable".

Let us join the peaceful revolution.

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